The Electrical Industry's Weekly Magazine February 22, 1960

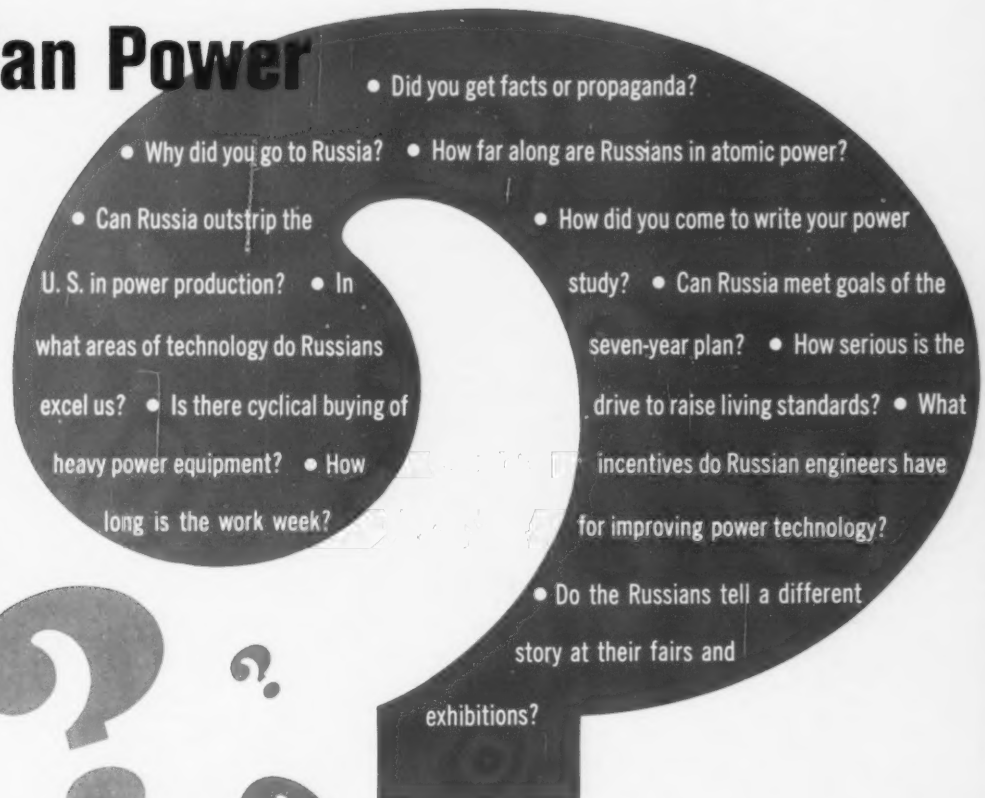
Electrical World

Price 50 Cents

A McGraw-Hill Publication

U. S. power team answers:

What's the Score On Russian Power


• Did you get facts or propaganda?
• Why did you go to Russia?
• How far along are Russians in atomic power?
• Can Russia outstrip the U. S. in power production?
• In what areas of technology do Russians excel us?
• Is there cyclical buying of heavy power equipment?
• How long is the work week?
• How did you come to write your power study?
• Can Russia meet goals of the seven-year plan?
• How serious is the drive to raise living standards?
• What incentives do Russian engineers have for improving power technology?
• Do the Russians tell a different story at their fairs and exhibitions?

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Cathodic Protection Coordinated on Submarine Cables... page 58

UNIV MICROFILMS INC
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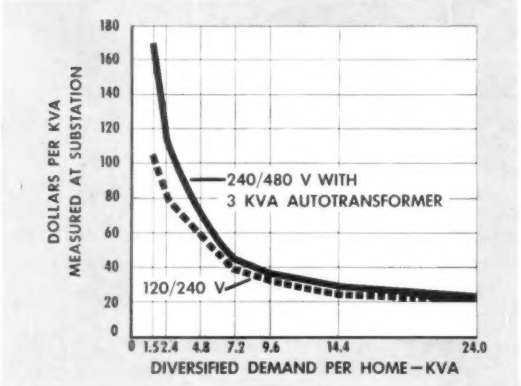
Distribution economies explored by computer:

25,000 Systems Designed in 2½ Hours

CONTRIBUTORS to the study are, left to right, H. E. Campbell, M. W. Gangel, R. C. Ender, V. C. Talley, all of General Electric's Electric Utility Engineering Section.



LOWER COST of the 120/240 v secondary system from feed point through meter is illustrated by this chart. Cost curves are based on 140 ft. secondary spans, 6750 kva load per feeder, and 12.47 kv primary.

CONTROLLING THE COSTS of an expanding residential power distribution system is one of the most complex problems faced by an electric utility today. To supplement the work of utilities in this area, General Electric engineers recently used a digital computer to calculate 25,000 combinations of the many cost factors involved. Their report, which analyzes these data, was presented at the winter general meeting of the AIEE.

SOME INPUT ELEMENTS supplied to the computer for its 2½-hour run were primary voltages of 4.16 kv and 12.47 kv, secondary voltages of 120/240 v and 240/480 v single phase, feeder loads, number of customers per transformer, number and sizes of primary mains and laterals, sizes and lengths of secondary conductors, voltage drops, and sizes and loadings of distribution transformers.

CONCLUSIONS of the study include the following:

- The 120/240 v linear coverage overhead secondary system is generally more economical than the 240/480 v system when served by a 4.16 kv or 12.47 kv primary.
- Except for the lighter customer demands supplied by a 4.16 kv primary, it is economical to load the primary feeders to the maximum levels considered in the study: 3000 kva at 4.16 kv and 9000 kva at 12.47 kv.
- For residential load levels within the range of 1.5—24.0 kva, a primary voltage of 12.47 kv costs less than 4.16 kv in areas of new construction.
- The system designed at the lowest cost does not necessarily use the entire available voltage spread. This is particularly true at the higher customer loads.
- A single secondary conductor size will economically serve a wide range of loads. Conductor sizes as large as 397.5 MCM Al can be justified at the larger loads considered.

A GROWING POPULATION and a rising standard of living call for a rapidly accelerating expansion of distribution capacity. This study indicates that the search for the most economical expansion pattern is greatly facilitated by the use of digital computers. For a copy of the report or for information about applying this study's techniques to an analysis of your own distribution system, write Section 604-01, General Electric Company, Schenectady, N.Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 153, No. 8 FEBRUARY 22, 1960

Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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POWERS American

PRESENTS THE SERIES PM-30 "Pole-Master®"

OSCILLATING HYDRAULIC DERRICK

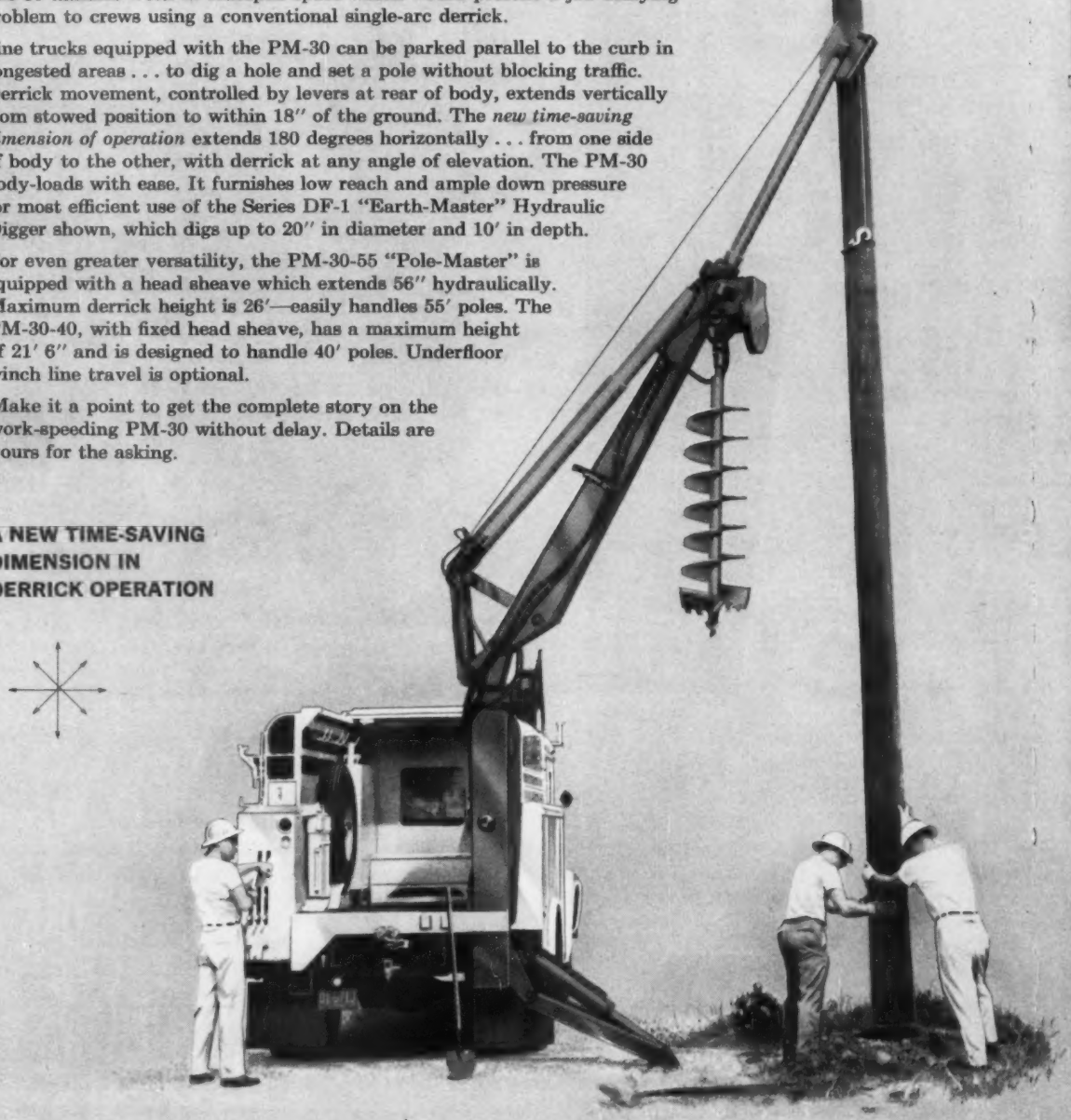
Think of the time that can be saved with this all-new "Pole-Master." Its scope of operation—*to each side as well as to the rear*—completely eliminates the necessity of positioning the truck precisely for each job. In alleys and narrow streets, the PM-30 handles work in cramped space which would present a job-delaying problem to crews using a conventional single-arc derrick.

Line trucks equipped with the PM-30 can be parked parallel to the curb in congested areas . . . to dig a hole and set a pole without blocking traffic. Derrick movement, controlled by levers at rear of body, extends vertically from stowed position to within 18" of the ground. The *new time-saving dimension of operation* extends 180 degrees horizontally . . . from one side of body to the other, with derrick at any angle of elevation. The PM-30 body-loads with ease. It furnishes low reach and ample down pressure for most efficient use of the Series DF-1 "Earth-Master" Hydraulic Digger shown, which digs up to 20" in diameter and 10′ in depth.

For even greater versatility, the PM-30-55 "Pole-Master" is equipped with a head sheave which extends 56" hydraulically. Maximum derrick height is 26′—easily handles 55′ poles. The PM-30-40, with fixed head sheave, has a maximum height of 21′ 6" and is designed to handle 40′ poles. Underfloor winch line travel is optional.

Make it a point to get the complete story on the work-speeding PM-30 without delay. Details are yours for the asking.

A NEW TIME-SAVING DIMENSION IN DERRICK OPERATION



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LETTERS

How Much Hydro Potential?

To the Editor:

One would think Electrical World would welcome a close look at U. S. hydro potential to see if there really is more power potential in the rivers than we now estimate. Instead, your Feb. 1 article "Implications of a New Argument" seems to contain a note of fear—generated, apparently, by viewing the problem under the department heading of "Politics and Public Power."

Surely all segments of the electric power industry could agree on the value of valid periodic inventories of all power resources.

Marvin Zelden
Electric Consumers Information Committee
2000 Florida Ave, N. W.
Washington 9, D. C.

▶ Opposing a re-evaluation of U. S. hydro potential is rather like being against motherhood. Per se, we don't oppose it providing it is more valid than what we now have. Reader Zelden finds it advantageous to interpret our copy beyond the point of our intent. The column to which he refers spelled out the political implications of a re-evaluation, citing the potential dangers to private enterprise inherent therein. We believe the private utilities should be kept aware of these dangers; hence, we will continue to bring forth interpretations. But nowhere in the column did we come out against a re-evaluation.

Boards—Not Educators—Set Policy

To the Editor:

As a school board member in a small community serviced by a large utility, I read with considerable interest your "Management Newsletter" dealing with help to local schools (EW, Dec. 28, p 123).

It is fitting and commendable that utility management is concerning itself with education. However, it was disappointing to find in the article statements which give tacit acceptance to a concept of educational control which has been responsible for much of our current problems in this field.

You state: "Remember that educators set school policy." This is simply not true—or should not be true. Local boards of education should set school policy. This is a prerogative that any self-respecting Board should never surrender to "professional educators." True—many have and with rather serious results as witness the many "socially adjusted" illiterates we are extruding from such schools. . . .

H. A. Hoover
John A. Roebling's Sons Div.
Trenton 2, N. J.

▶ Reader Hoover makes a telling point, but in the context of our newsletter, we think it would be more appropriate to offer aid through a superintendent than through a school board.

LOWEST-COST TRANSMISSION LINE

Armless pole design eliminates crossarms, braces, hardware . . . saves up to one-third in material . . . more in labor of erection. Because insulator is stronger than crossarm, permits longer spans, larger conductors, greater safety margins. Requires narrowest ROW. Easiest-ever for hot-line work.

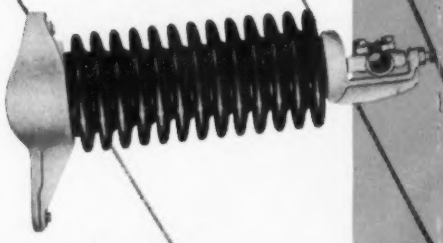
BEST-PERFORMING TRANSMISSION LINE

Horizontal mounting of Line Post encourages uniform wetting and self cleaning, improves wet flashover values by as much as 15% over upright ratings. Eliminates contamination flashover and pole-top burning.

BEST-LOOKING TRANSMISSION LINE

Neat, unobtrusive appearance avoids customer objection in urban and suburban residential construction. Can handle 69 kv, or higher, yet looks more like a "small" distribution line. Permanently free of RIV and TV interference, too.

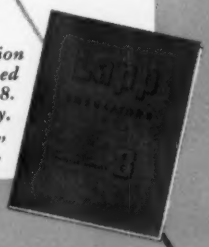
the insulator for armless transmission



Lapp Line Posts with clamp-top and integral-base-and-gain for horizontal mounting are available in voltage ratings of 35 kv, 45 kv, 55 kv, 66 kv and 88 kv. Each insulator is held by two through-bolts, and entire structure is easily assembled on the ground before erection.

Lapp

Modern armless construction with Lapp Line Posts is explained in detail in the new Lapp Catalog No. 8. Write for your copy. Lapp Insulator Co., Inc., LeRoy, N. Y.



You can save money on bookkeeping time with Graybar as your auxiliary warehouse

At least half of stores' transactions cover items costing under a dollar. So it's easy to see how total bookkeeping time can be topheavy.

However, when you make Graybar your auxiliary warehouse for electrical equipment and supplies, you open possibilities for savings. An increase in the number of items on the Graybar order, can save you time in writing orders and in processing them. So can the blanket order for a specified period. Other measures save at inventory and auditing time.

Start with a local call . . . Let the Graybar man come in, study your system, and submit recommendations. You'll find it worthwhile.

Employee-owned Graybar, a part of your local community, has served utilities continuously since the first lines went up. Whether you require 3 items or 3,000, Graybar is your most practical source for most electrical utility equipment and supplies.

When Graybar is your auxiliary warehouse—	You save on storeroom costs Reduce inventory investment Insure prompt delivery Step up manhour efficiency Simplify bookkeeping

933

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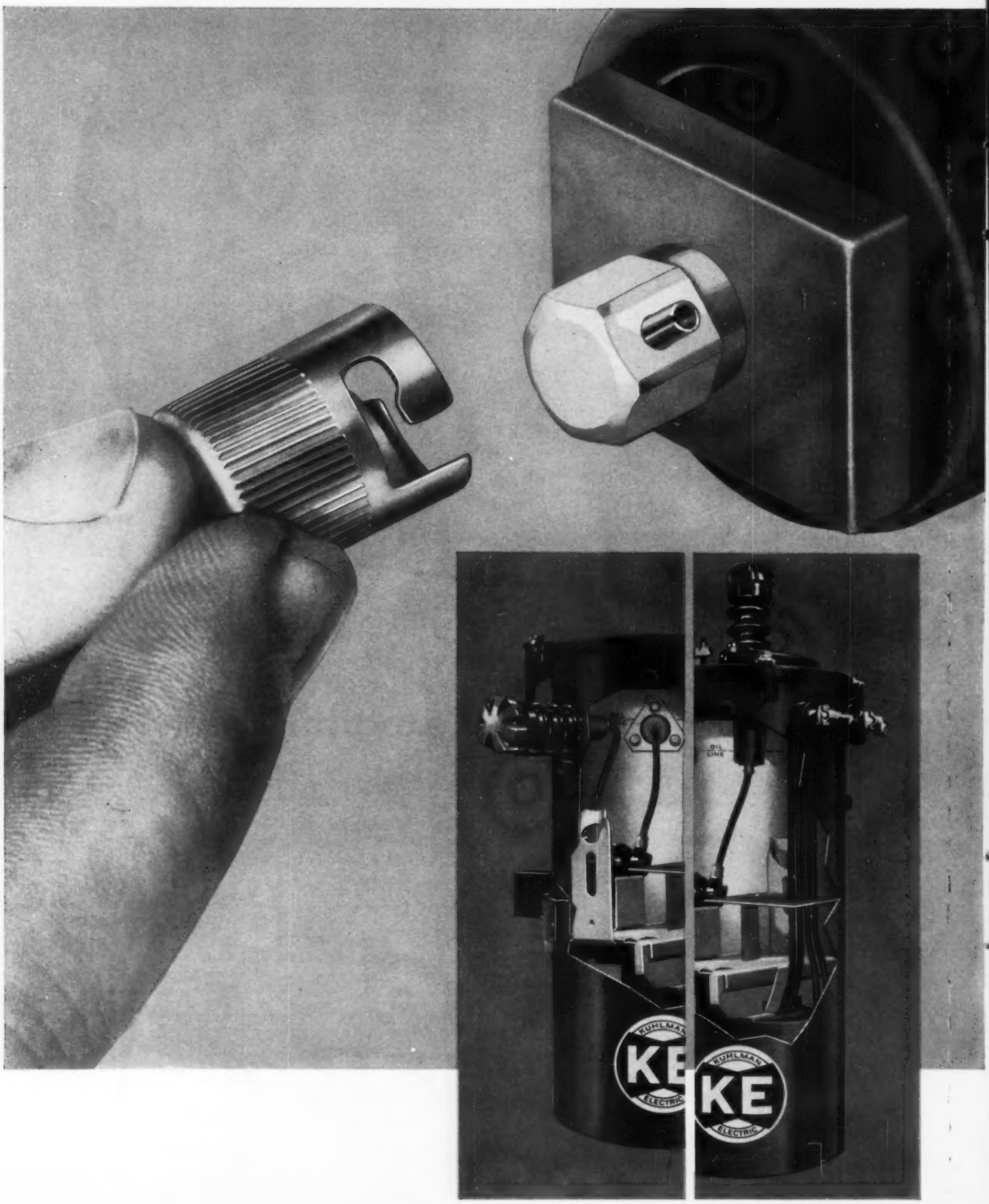
"GraybaR" Everything Electrical "GraybaR" ELECTRIC COMPANY

IN OVER 130 PRINCIPAL CITIES

LOCAL SERVICE TO UTILITIES THROUGH COAST-TO-COAST WAREHOUSING

NEW Quick Disconnects Make Kuhlman

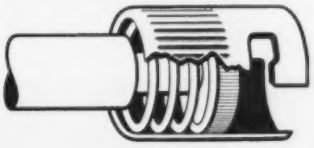


The Simplest Transformer To Service

Disconnecting high voltage leads or replacing internal fuses takes only a matter of seconds in the newly designed Kuhlman Pole-Type transformer.

High voltage bushings (sidewall or cover mounted) are connected or disconnected by a finger tip bayonet-type connector. A slight turn to the right connects. A slight turn to the left disconnects. No longer is it necessary to fumble with tools in close quarters or hunt for lost nuts or bolts.

The new Kuhlman high voltage internal connector assures more positive contact, too. The connector's lock pin is guided into position by a grooved joining cup. With a slight turn it locks in place under spring pressure, assuring positive contact always.

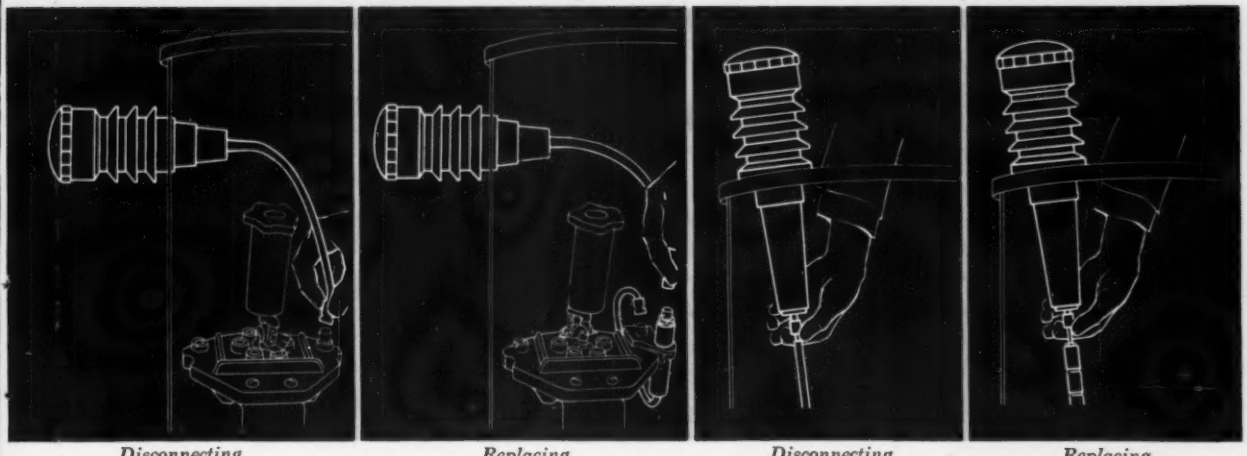


In the event a sidewall bushing fuse has to be replaced, it now can be done in a jiffy, right on the pole. A convenient spring clip releases the fuse from its mounting. Fuse disconnects break the line and coil connection and allow the blown fuse to be replaced without the use of tools.

Disconnecting cover-mounted bushings to remove the transformer cover is even simpler. An easily-reached quick disconnect at the base of the bushing disconnects the high voltage lead. Bushing-mounted protective link fuses are changed by the same simple device.

Quick disconnects are only one of many features. Get all the facts about the *all new* '60 Kuhlman transformer . . . that gives you more for your transformer dollar.

These connections now require no tools—are simpler to make:



Disconnecting sidewall bushings

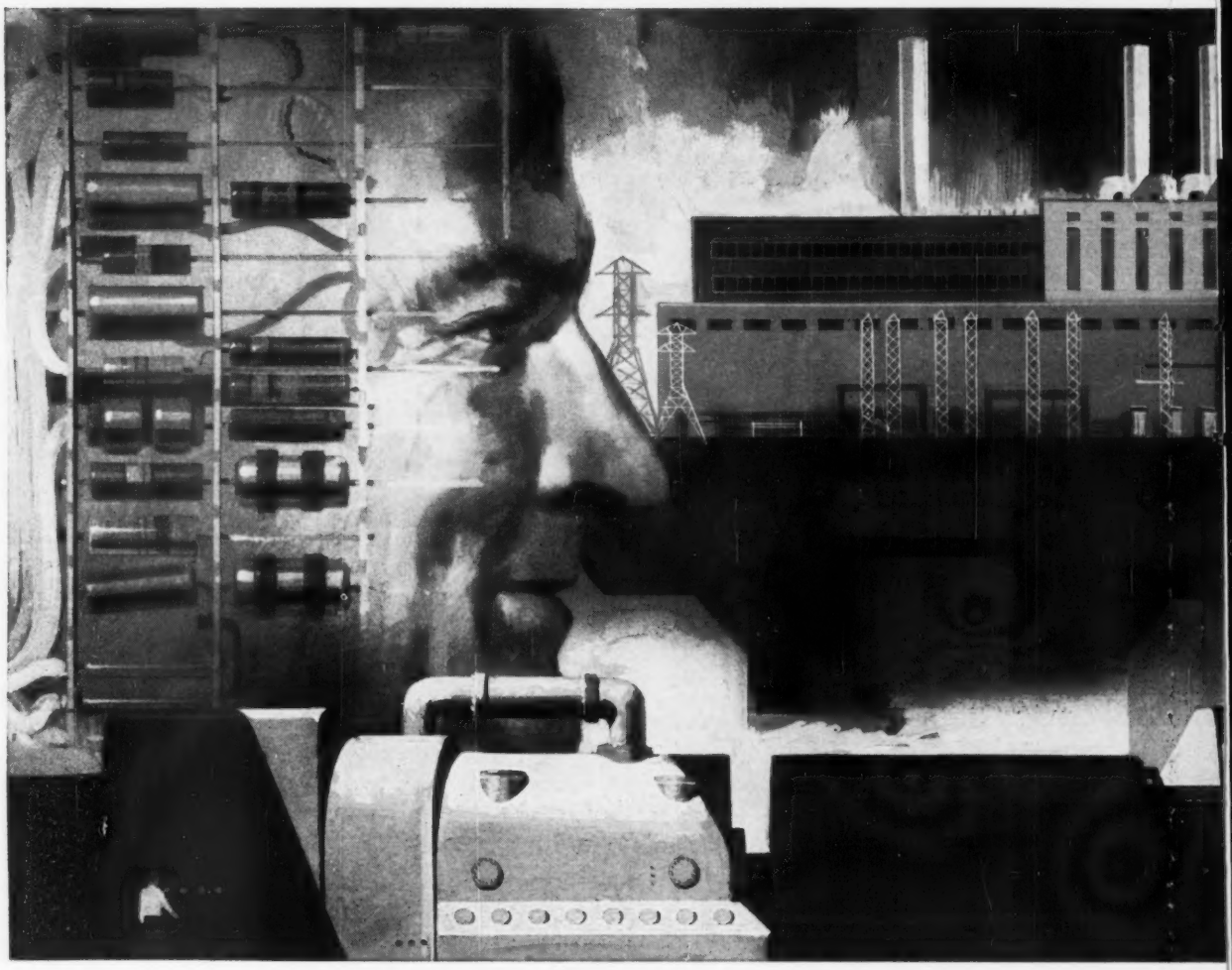
Replacing sidewall bushing fuses

Disconnecting cover-mounted bushings

Replacing cover-mounted fuses

KUHLMAN POLE TYPE TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Mich. **Factories at Bay City, Mich.; Crystal Springs, Miss.; Salinas, Calif.**



Westinghouse PRODAC computer-controlled system operates your power plant automatically

Integrates all station controls to increase efficiency, reliability, to decrease operating costs, risks of emergency decisions

The completely automatic power plant is a reality with Westinghouse PRODAC* . . . the system of *PRO*grammed *D*igital *A*utomatic *C*ontrol utilizing an advanced control computer.

The Westinghouse Prodac digital control computer is designed specifically for control systems, with a logic unit and priority director to simplify and expedite making the "thousands of decisions" needed in sequencing and control of a power plant; and to change the sequences automatically whenever needed to start up, shut down, or run the plant at maximum efficiency under normal and emergency conditions.

The Prodac system not only scans and logs system quantities, but through extensive calculations presents them directly in more meaningful terms of heat rates and unit efficiencies. By analyzing these, it can make required changes in controlled quantities to optimize performance of the entire plant.

*Trade-Mark

Prodac ties together other control subsystems such as generator hydrogen control, automatic turning gear, turbine starting speed control, with combustion, feedwater and superheat control.

Above all else, the Prodac system design stresses reliability. In the design of the computer, its application and integration with auxiliary controls, the focus of all engineering considerations is to provide the most complete, most reliable control of the turbine-generator, the boiler and all auxiliaries.

Westinghouse will design and build the complete control system. Westinghouse will, in addition, coordinate the total plant project . . . boiler, turbine-generator, transformers, auxiliaries and other apparatus. The benefits of automation may be extended throughout your generating facility. To integrate all stations, Westinghouse offers a completely automatic dispatching system.

THE WESTINGHOUSE NEW POWER CONTROL AND COMMUNICATIONS DEPARTMENT ENGINEERS AND MANUFACTURES:

Systems: supervisory control
voltage regulator
turbine supervisory
automatic dispatching
automatic power plant control
digital telemetering
scanning, monitor and logging (in plant)
scanning, monitor and logging (remote)

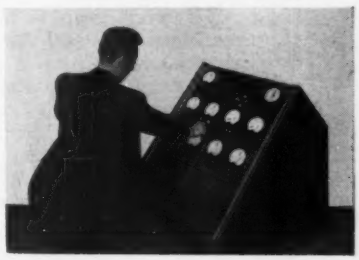
Nuclear: instrumentation and control

Communications: microwave
multiplex
power line carrier

WESTINGHOUSE AUTOMATIC DISPATCHING INCREASES FLEXIBILITY, REDUCES OPERATING COST OF ENTIRE GENERATING SYSTEM. The Westinghouse Automatic Dispatching System provides accurate control of total generation and continuous economic dispatch. Intercompany commitments are maintained while greater economies are realized through accurate computations of transmission losses and incremental loading.

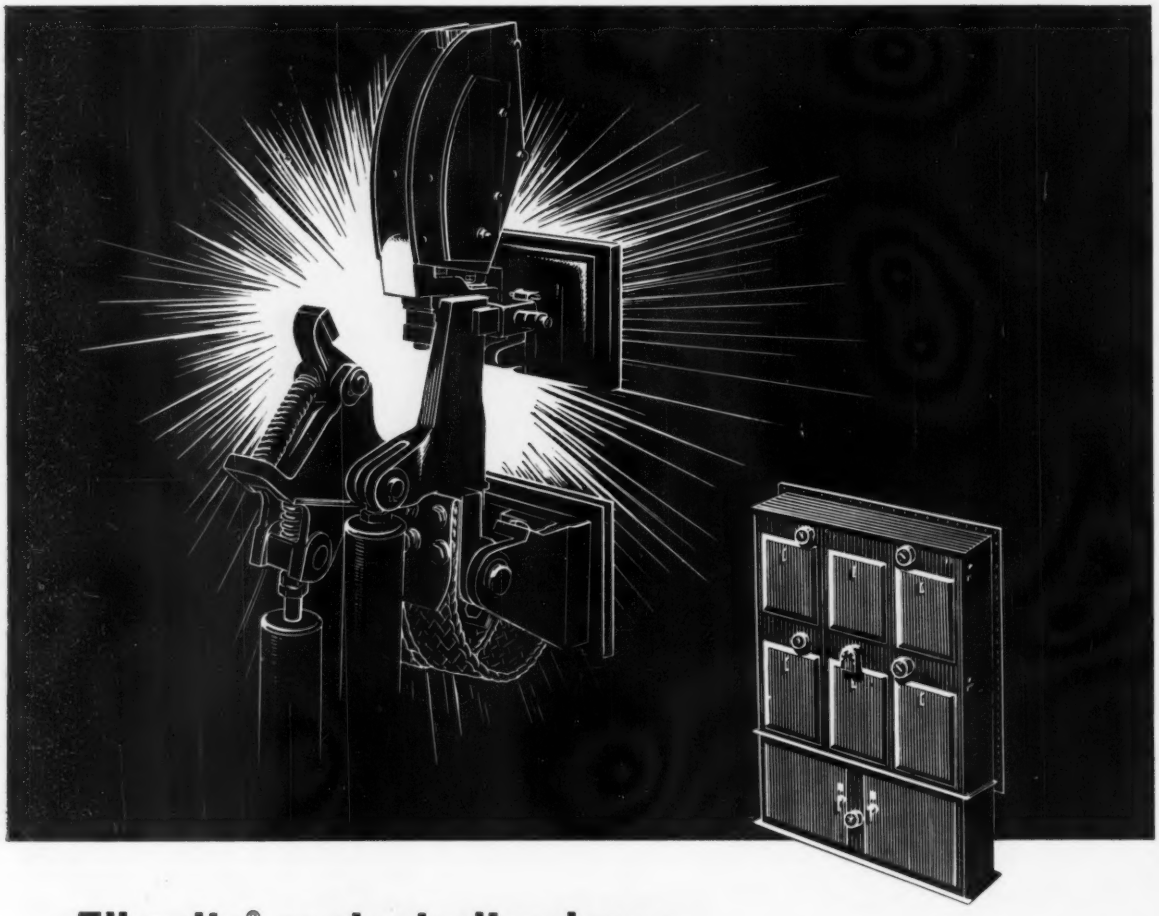
Maximum capability of all machines can be utilized, if necessary, to meet system emergencies without endangering equipment. Massive complexity of today's power systems has forced new levels of accuracy and flexibility. In full consideration of this, Westinghouse offers you an automatic dispatch system that will rapidly repay your investment.

J-60988



YOU CAN BE SURE... IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV ALTERNATE FRIDAYS



Elkonite® contacts live longer... even in tough tap changer transfer switching

To get the most in dependable performance and long life from your tap changing equipment for substation and regulator applications, always specify Elkonite contacts.

Elkonite materials are engineered to stand up under the rugged demands of tap changing under load—hot, frequent arcs . . . heavy physical blows. Mallory utilizes powder metallurgy techniques developed through years of pioneering and contact research to combine the heat resistance of refractory materials with the electrical characteristics of the high conductivity metals. Working with apparatus designers, our engineers select the exact qualities required for each application—the right combination of density, hardness, arc erosion resistance, conductivity and mechanical strength. Every step of processing is rigidly controlled to assure you of the highest quality contacts.

This extra care pays off in the extra performance you get from equipment in which Elkonite contacts are used. Specify Elkonite . . . don't settle for less.

From generator to user,
Mallory contacts serve the nation's utilities

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ALLIS-CHALMERS

Originators of 5/8% Step Regulators

Hang up the "climbers"!

New JFR regulators offer safe, ground-level adjustment

It's standard with Allis-Chalmers! Position indicator drag hands adjust from the ground at the remote control panel. Saves poles, ends risky pole climbing and makes recording of operation range practical. At the push of a button, indicator *drag hands* are reset on large, easy-to-read face with reflecting numbers and indicator hand.

There's much more for you in this all-new design. It's the most advanced regulator on the market today. New sight indicator gives you fast check of oil level. Newly designed cover, with hidden bushing mounting studs, cuts maintenance. JFR's now lower, lighter . . . slashes transportation, handling and installation charges. Ask your nearby A-C office for new JFR bulletin 21B7977E or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Feather-Touch is an Allis-Chalmers trademark.

- External by-pass arrester
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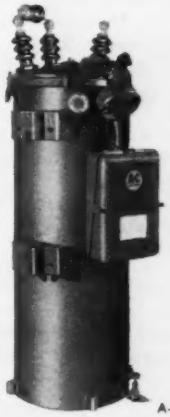


A-1216

Even your dome light draws more current than MOTRAC 2-way radio!

Motorola ends costly power drain problems and idling expense with the first fully transistorized receiver and power supply

What makes Motorola MOTRAC radio the most economical and reliable 2-way radio unit in the annals of mobile communications? Not just one or two new features, but a score of revolutionary design advancements that bring you the very finest set ever engineered.

1. On standby—the MOTRAC receiver draws only a trickle of current—actually 80% less than conventional units—with an occasional increase to maintain crystals at proper temperature for precise on-frequency operation (even your dome light draws more current than MOTRAC radio). Yet, this radio is always poised for instant reception, thanks to its fully transistorized receiver. Result: no life-shortening battery drain . . . no more costly, unnecessary engine idling.

2. MOTRAC radio eliminates the most common maintenance problems: vibrators in the power supply and tubes in the receiver. All are replaced by stabilized long-life transistors.

3. Up to 40°F cooler operation means less aging and strain on components. Reason: no more receiver tube filaments; a more efficient power supply; a battery saver switch to cut off transmitter filaments; and two separate heat sinks—one for power supply, another for transmitter output tubes.

4. The MOTRAC receiver operates directly from the 12-volt battery; its low voltage operation results in less electrical strain on components, assures long life.

5. Traditional Motorola engineering and production excellence are evident throughout MOTRAC radio. Transistors undergo three separate checks, including a week of stabilization at 185°F. Only industrial-type tubes, especially suitable for the rigors of mobile operation, are used in the transmitter.

6. Patient production testing continues under stringent quality control procedures. First, each module is tested. Then each chassis is independently checked. Next, each radio is tested as a composite whole. Finally, the entire radio and associated accessories are checked out as a complete operating system.

7. MOTRAC radio is conservatively designed. The receiver has *even higher* reserve gain than conventional Motorola units to assure *peak performance* for many years. Also, power supply transistors are operated under an exceptionally high safety factor to assure extended service life.

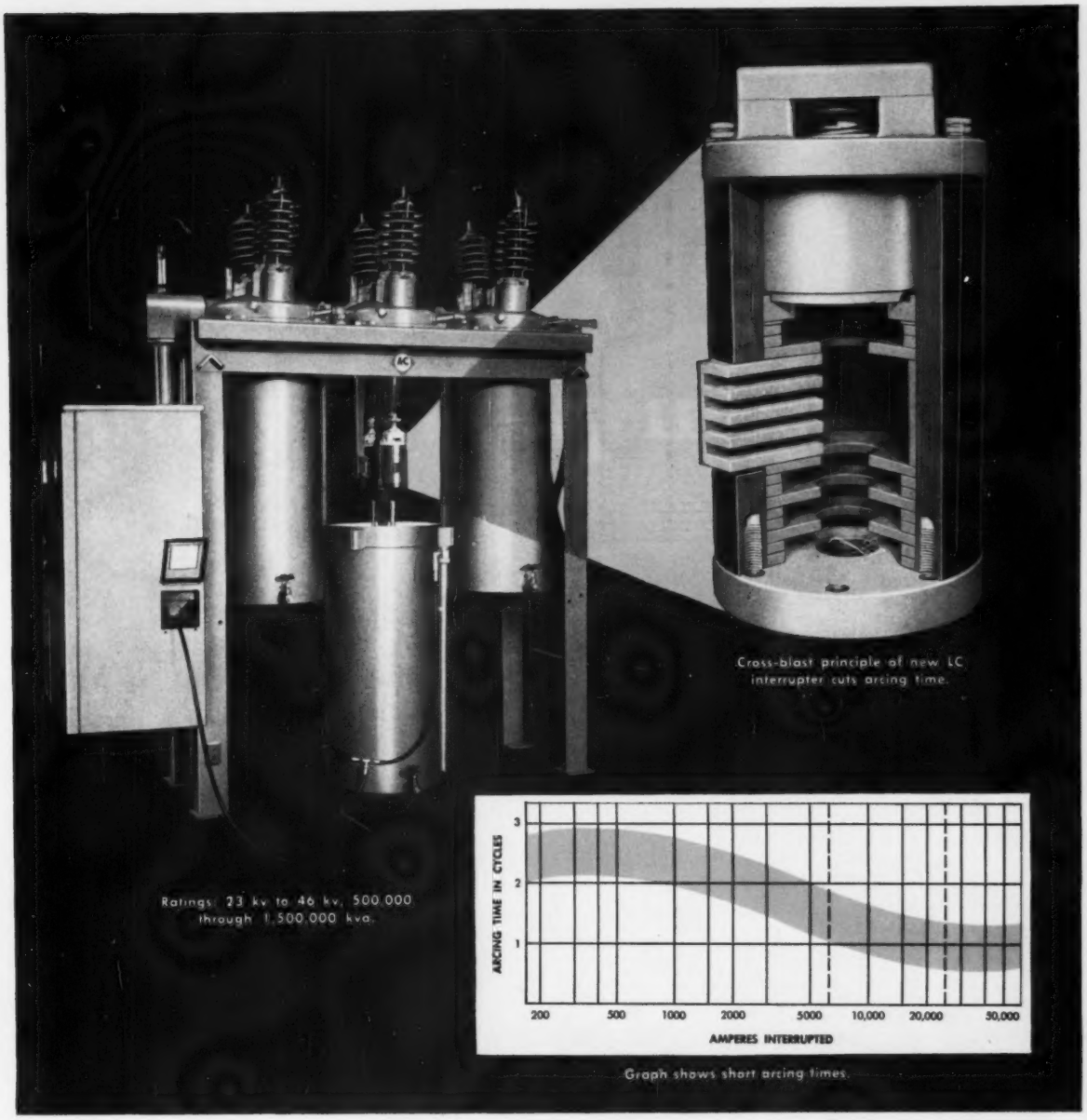
8. Completely independent receiver and transmitter chassis, with no power supply in common, assure reliable reception regardless of transmitter performance.

9. MOTRAC radio offers you 2½ to 3 times higher audio output than conventional sets.

10. MOTRAC radio is designed for split-channel operation. *Both* receiver and transmitter meet critical split-channel stability frequency requirements.

Experienced users have been field testing MOTRAC radios for many months. The results are in—and they're excellent. We'd like to tell you *all* about them. Write, wire or call: Motorola Communications & Electronics, Inc., A Subsidiary of Motorola, Inc., 4501 West Augusta Blvd., Chicago 51, Ill., SP 2-6500. MOTRAC is a Motorola, Inc. trademark.

ALLIS-CHALMERS



industry's newest interrupter

Here's new high-speed interrupting efficiency for Allis-Chalmers frame-mounted circuit breakers. New LC interrupter cuts arcing time. There's greater system protection, less oil contamination. Dielectric strength is extended, maintenance lowered.

More A-C breaker bonus benefits! You get mechanically trip-free operation. Highly successful *Pneu-Draulic* operator provides fast operation—ends moisture, rust, freezing. Hydraulic power-operated tank lifter cuts raising and lowering time by 80%.

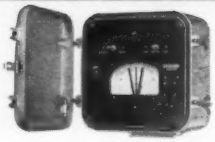
For all the facts on these frame-mounted breakers, call your nearby A-C office or write **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.*

Pneu-Draulic is an Allis-Chalmers trademark. A-1248

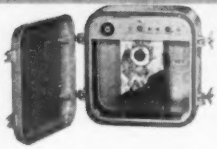
achieve optimum system performance

with SANGAMO

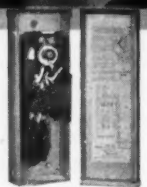
Socket type voltage Lincolntrol



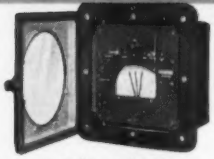
Voltage Lincolntrol with thermostat bias



Carryover socket type time switch



Carryover type time switch



Switchboard type Lincolntrol

STATEMENT:

Installed in greater numbers every year, power capacitors are enabling many electric systems to approach unity power factor at peak load. However, capacitors installed in excess of light load kvar requirements must be switched to obtain optimum performance with maximum benefits.

PROBLEM:

System kvar loading and its effect on system operation varies widely during the daily load cycle . . . from day to day, from season to season, from feeder to feeder. Application of capacitor kvar in excess of circuit kvar loading can result in overvoltage, increased losses, and generator instability. Hence, capacitors installed in excess of light load kvar requirements must be switched to obtain optimum performance with maximum benefits.

Sangamo LincoIntrols measure an electrical quantity (volts, amperes, kilowatts, kilovars) and, as a function of that quantity, initiate operation of capacitor switches. The signal relay element is a time-proven Lincoln thermal meter . . . simple, rugged, accurate. Its inherent time-lag characteristic is ideally suited to capacitor switching.

LincoIntrols include all the customary accessories . . . fuse, manual switches, counter. They are supplied in strong, durable and weatherproof cast aluminum enclosures for socket or conduit connection, or in indoor construction for conventional bottom connection or switchboard mounting.

AUTOMATIC CAPACITOR CONTROLS

SOLUTION:

Specify Sangamo Capacitor Controls—whether you automatically switch capacitors as a function of voltage, current, watts, vars, temperature, time, a combination of these, or in sequence, there's a Sangamo control to do the job . . . the most complete line of capacitor controls in the industry.

Sangamo Time Switches provide automatic capacitor switching on predetermined time schedules. Relatively low in cost, they are the service-proved time switches with holiday cutout and automatic carryover (that keeps them running during power interruptions for as long as 10 hours). Time switches, in combination with other controls, have been perfected to best meet certain application requirements.

PCeo-2

SANGAMO ELECTRIC Company

SPRINGFIELD, ILLINOIS

KEEP PACE ELECTRICALLY

"By installing BERMICO CONDUIT at breakneck speed, we kept project work moving on schedule"

WILLIAM McCABE, Vice-President
Lord Electric Co., Portland, Oregon

Under construction. Lloyd Center, Portland, Oregon, one of the nation's largest metropolitan business-shopping developments, costing an estimated $30,000,000. 20,000 KVA initial power requirement.

"PRIME CONTRACTS for the Lloyd Center were let four months before the electrical contract," pointed out Mr. McCabe, Vice-President and Manager of the Portland office of Lord Electric Co. "By the time we were awarded our contract — the site was ready for the electrical conduit, so we had to move fast.

"Fortunate for us, Bermico was specified. By installing Bermico Conduit at breakneck speed, we kept project work moving on schedule."

Bermico Conduit is a great boon to electrical engineers, contractors and utilities. It is lightweight, easy to handle, simple to cut and assemble. Each 8-foot length is precision engineered, with smooth inside bore to allow easy pull-through without abrasion. Bermico is made from cellulose fibre, impregnated with coal tar pitch. It is extremely resistant to acids, alkalies, heat, water and corrosion — and of high dielectric strength. Use Bermico on *your* next job.

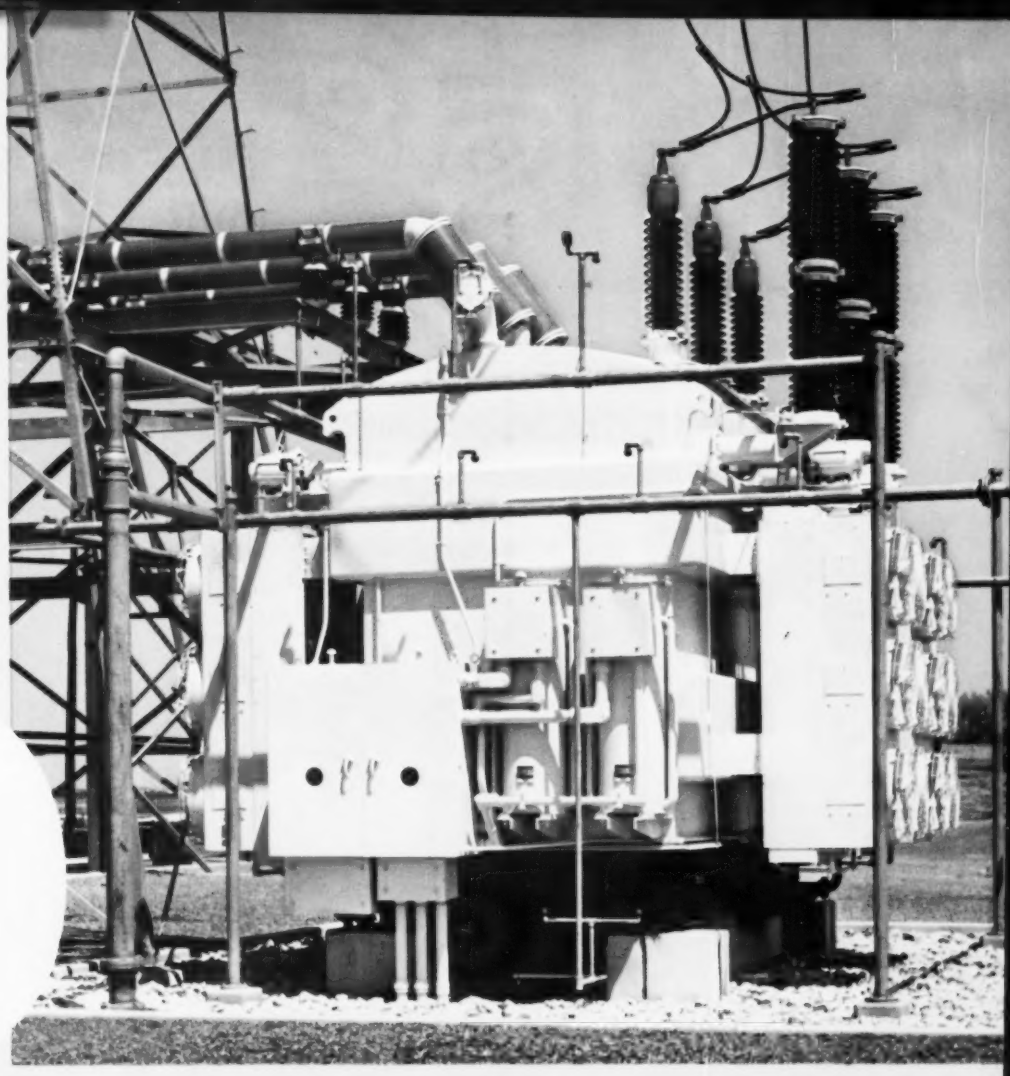
Distributed by WESTINGHOUSE Electric Supply Company and Agent Jobbers. Offices in Principal Cities.

Another quality product of

BROWN QUALITY COMPANY

General Sales Office: 150 Causeway Street, Dept. 1320, Boston 14, Mass. *Mills:* Berlin, N. H.; Corvallis, Oregon

140,000—kva Pennsylvania Power Transformer with additional 10,000-kva reserve capacity. Shell-form, Contour Design. Three phase. Forced-oil, forced-air-cooled. High voltage: 132,000 Grd. Y/76,200 Δ volts. Low voltage: 14,400 Δ volts.



Tailor-made for "BIG D" in the "Lone-Star State"

140,000 KVA PENNSYLVANIA TRANSFORMER HAS RESERVE CAPACITY FOR SERVING THE DALLAS OF TOMORROW

The story of Dallas Power and Light Company is typically Texan, whether told in past, present or future tense. In the few years since 1954, the capacity of the utility has nearly doubled, until it now stands at 956,000 kilowatts. By 1962, another 350,000 kilowatts will have been added.

In light of the utility's rapid growth, it is not surprising that a 140,000-kva Pennsylvania Power Transformer with a "built-in" reserve capacity was chosen for the most recent addition to the system—a 125,000-kilowatt generating unit at Mountain Creek Plant. The transformer is cooled by means of forced-oil-to-air heat exchangers, with four coolers in operation when the transformer is loaded to its normal 140,000-kva capacity. With a fifth cooler, the transformer operates continuously at 150,000 kva.

In keeping with the standard practice made possible by Pennsylvania's shell-form, Contour Design, the transformer was shipped in an upright position with only major accessories removed. As a result, installation time and cost were kept to a minimum.

Pennsylvania has the facilities and the experience needed to provide efficient, economical answers to both "standard" and unusual power transformer requirements. Contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

See next page for some facts on facilities . . . . . .

PENNSYLVANIA TRANSFORMERS

McGRAW EDISON

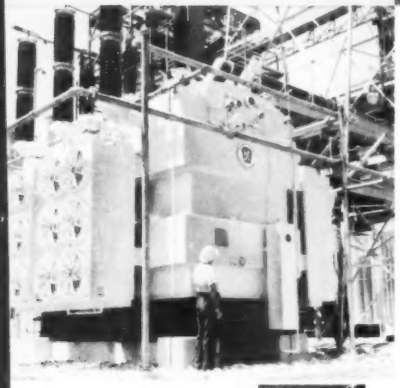
PENNSYLVANIA POWER TRANSFORMERS

CORONA TESTS CONDUCTED ON 460-KV TRANSFORMER

Highly sensitive equipment recently installed at Pennsylvania Transformer permits the detection of the slightest amount of corona during insulation tests on the transformer. The apparatus serves a double purpose: to check present production, and to help plan the transformers of the future.

The transformer undergoing corona tests in the accompanying photograph is a 460,000-volt prototype of transformers to come, as Pennsylvania prepares to satisfy the demands of utilities for transmission voltages above the present 345,000-volt level.

Shielding on top of the transformer eliminates all electrical discharges into the air, so that the corona level of the internal parts of the transformer may be accurately studied.



Pennsylvania has the facilities and the capability to meet the largest power transformer requirements

- A large, expertly staffed engineering department with long experience in power transformer design—both core form and shell form.
- The ability to design and construct scale models for proving design characteristics.
- A modernly equipped plant capable of producing and testing the highest rated units contemplated by industry today.
- Handling and loading facilities that permit full utilization of manufacturing, shipping and installation economies.

See other side for Pennsylvania Power Transformer installation

PENNSYLVANIA TRANSFORMERS

McGRAW EDISON

PENNSYLVANIA TRANSFORMER DIVISION

McGRAW-EDISON COMPANY • CANONSBURG, PENNSYLVANIA • GREATER PITTSBURGH DISTRICT

The Electrical Week

LATE NEWS ▶ **Philadelphia federal grand jury returns four more indictments.** In addition to those reported on page 46, four indictments were returned charging the companies below with "fixing and maintaining the prices, terms, and conditions of sale" of the listed products:

Bushings—General Electric, Westinghouse, Lapp Insulator, and Ohio Brass.

Lightning arrestors—GE, Westinghouse, Ohio Brass, McGraw-Edison, H. K. Porter, Hubbard, and Joslyn.

Insulators—Ohio Brass, Lapp Insulator, GE, Porcelain Insulator Corp, I-T-E Circuit Breaker, A. B. Chance, McGraw-Edison, and H. K. Porter.

Open fuse cutouts—Westinghouse, GE, A. B. Chance, Hubbard, I-T-E, Joslyn, McGraw-Edison, and Southern States Equipment.

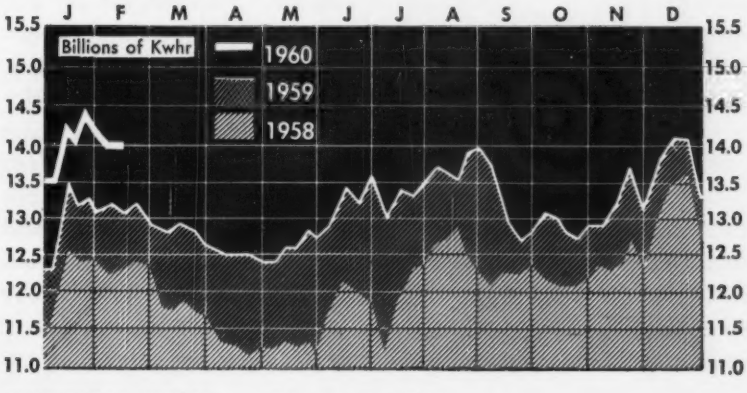
Civil suits were also returned for bushings, arrestors and insulators. The investigation will continue.

Five companies are nominated for Edison Award. They are: Commonwealth Ed (A-power development); Detroit Edison (promoting civic responsibility); Duke Power (Catawba River project); United Illuminating (urban redevelopment); and Western Masachusetts Electric (space heating to commercial buildings). Winner will be announced at EEI Convention in June.

Bonneville gives final recommendation to Senate Interior Committee reiterating its earlier recommendation in favor of single 230-kv line tying it to Pacific G&E. BPA points out that a bigger line (proposed for federal construction) would not be economically feasible.

Utilities will be legally liable for service interruptions in Kentucky if a recently received bill in the state legislature becomes law. Only exception for interruption would be an "Act of God."

WEEKLY POWER OUTPUT—Up 7.0% (Week ending Feb. 13), Kwhr 14,071,000,000



Per Cent Change From Previous Year

	Jan. 30	Feb. 6	Feb. 13
Total U. S.	+ 8.8	+ 6.1	+ 7.0
New Eng.	+ 5.4	+ 4.7	+ 3.1
Mid. Atlan.	+ 6.5	+ 6.4	+ 5.8
Cent. Ind.	+ 9.1	+ 7.2	+ 8.8
West Cent.	+ 5.2	+ 2.4	+ 3.9
Southeast	+11.1	+ 4.5	+ 9.2
South Cent.	+ 9.1	+ 7.9	+ 7.5
Rocky Mount	+11.3	+ 3.5	+ 4.4
Pacific			
NW	+ 8.6	+ 5.7	+ 2.3
SW	+10.2	+ 9.6	+ 6.0

Seasonally Adjusted Index 265.2

Week Ago 264.9 Year Ago 248.0

Source: Edison Electric Institute

Preview of This Issue

EVENTS ▶ **Russia's gains and drawbacks in power matters** are topics dealt with in new EEI booklet. U. S. power men who helped write it answer questions in exclusive EW interview **(p 42)** . . . Grand jury in Philadelphia returns 23 indictments of electrical manufacturing companies and executives in anti-trust case **(p 46)** . . . Problems of power salesman discussed **(p 47)** . . . "202" hearings on atomic energy preceded by AEC 10-year plan **(p 48)** . . . Illinois Supreme Court rules utilities using liberalized depreciation cannot normalize tax deferral **(p 102).**

ENGINEERING ▶ **The details on American Electric Power's coal-gas burning turbine** are covered in a four-page, by-lined story beginning on **page 49.** The 5-Mw unit, to operate as part of a combined cycle at Ohio Power Co's Muskingum River plant, is the first of its kind for generating purposes . . . Work simplification saves Detroit Edison about $100,000 worth of engineering time a year **(p 53)** . . . Seattle City Light designs power supply to two 25-Mva industrial electric furnaces so that voltage fluctuations to nearby customers is limited to 0.5 v on a 120-v base **(p 55)** . . . Three companies had to get together on cathodic protection in the laying of Consumers Power's 46-kv cable under the Straits of Mackinac **(p 58).**

Politics and Public Power

THE HEARINGS CHANGED NOTHING

The House Interior Committee on Irrigation and Reclamation went through all the motions last week of holding final hearings —prior to voting—on the controversial federal Burns Creek power dam.

It's doubtful whether the testimony changed a single vote on the subcommittee. In fact, it was apparent that subcommittee members were asking questions of the witnesses, not to learn new information, but rather to justify their own positions.

The issue was simple: Another federal subsidy for preference customers.

Burns Creek would supply 90,000 kw, cost about $50 million; and, although it'd be called a reclamation project, 98.2% of its costs would be allocated to power—only 1.7% to reclamation.

Because Burns Creek is almost devoid of reclamation benefits, its power facilities are left almost naked for scrutiny by all sides.

However, it's not that simple. The main issues were fuzzed over with side ones, political philosophies, and the complicating problem that Burns Creek was designed to be operated, not alone, but in conjunction with the Palisades Project.

Admittedly, Burns Creek would be unfeasible, if operated alone. Its capital investment of about $550 per kw is almost ridiculously prohibitive. However, its feasibility is almost undecipherable when it has to be judged as an integral part of Palisades. Federal power advocates would have you believe that the combination of Burns Creek and Palisades would more than double the annual revenues from Palisades alone—thereby doubling the value to irrigators and power users in the area.

PROCUREMENT & PRODUCTS ▶ Federal grand jury in Philadelphia has expanded its probe into additional product lines of electrical manufacturers . . . Compact cars save about 25% in gasoline costs, say 100 purchasing agents (p 76) . . . Leeds & Northrup incorporates new digital computer in its control system . . . Line Material puts up a 7.2/12.5-kv substation in 48 minutes (p 79) . . . Units substation for industrial and commercial buildings is available . . . Remote indicator locates and identifies outages on a utility network automatically (p 88).

MANAGEMENT ▶ **What will money cost in 1960?** It's a question Wall Streeters are thinking about with puzzled optimism. The steep fluctuations in the stock market that have characterized the year so far, the probable course of inflation, and other factors—including a predicted surplus in the federal budget—all enter into the picture. For a comprehensive rundown, turn to this week's Management Newsletter on **page 83.**

SELLING ▶ **California engineers win IES award for a bank job** that robbed no one. Rather it increased the institution's lighting four-fold (p 92).

NEXT WEEK ▶ **Part II of EW's 56th Annual Statistical Issue will be published,** covering sales, revenues, average use, capacity additions and other data.

They quietly hedge the fact that the payout period for Burns Creek (irrigation and power) would exceed the normal 50-years.

Conservatives, opposing the project, ask, on the other hand, how a project which can't stand on its own feet, can help another project without sucking away the latter's advantage. "Add a lemon to a lemon, and you don't get a peach," said Board Chairman Robert Ginna of Rochester Gas & Electric.

Rep Gracie Pfost (D-Ida.), who is anxious to see the project built, cloaked the basic issue of federal subsidy in the garb of a great moral issue by asking Ginna whether his opposition also means he opposes "the little Idaho farmers" who help feed Rochester mouths.

Ginna asked the subcommittee why the federal government should spend $50 million when it could get the same amount of power from a $3-million thermal plant.

The best "answer" came from Mayor J. L. Salmon of Burley, Ida., who claimed the project would provide flood control for his town. Rep John Saylor (R-Pa.) rebutted Salmon by charging, "If those people in reclamation can't justify any of this project for flood control, there just isn't any to be had."

Other issues involve: (1) Whether Burns Creek would encroach on the thermal plants of Utah Power & Light or Idaho Power; and (2) Whether "everybody in Idaho except the private power company is for Burns Creek."

A conflict between municipal preference power users and rural irrigators in Idaho may delay the bill, but otherwise, its passage seems sure. The appropriations have been approved, the Senate has authorized the project, and a favorable House vote is expected.

The hearings changed nothing.

Executive Reader

A completely oil-powered home is not as far away as most people think, according to Fred Heaney, Oil Institute of America. With a low-powered, oil-fired turbine to turn a home generator, a residential customer will be able to save significantly on the cost of electricity. An adequate supply of energy would be stored on the user's premises to preclude the possibility of outage due to storms or other phenomena. **Journal of Commerce, January 29, 1960.**

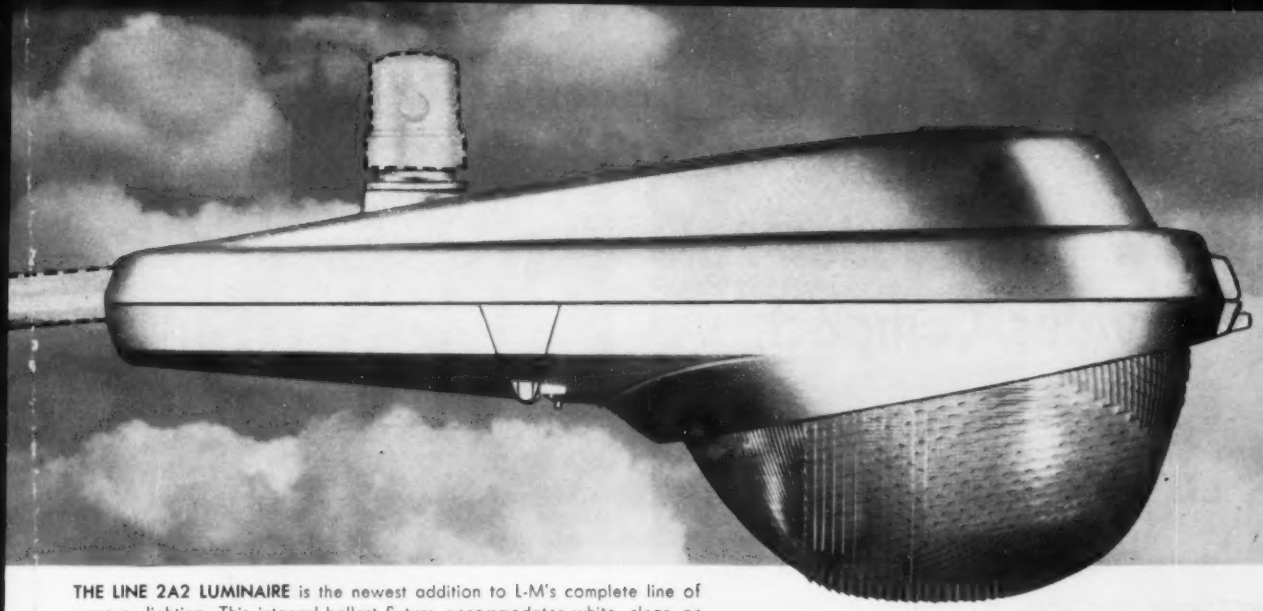
Less power is needed by an electric furnace to melt iron ore in a new direct reduction process that uses ore reduced to about 80% metallic iron. A pilot plant used less than 1,000 kw to produce a ton of iron. Pilot plant studies by Swindell-Dressler Corp indicate that capital cost for the new process, called Orcarb, will be about half of that for blast furnace facilities. **Steel, January 11, 1960.**

A fast electronic memory and the fastest switching transistor will make their marks on computer technology. The new and accurate memory is reported to be comparatively inexpensive, easy to produce, and capable of supplying bits of information to the processing section in millionths of a second. Hair-thin wires wrapped with magnetic metal tape in a spiral lay plus tiny bar magnets are the basic elements of the permanent memory. **Western Electric Co and Bell Telephone Laboratories, New York, N. Y.**

Production has started on the world's fastest switching transistor at Raytheon Co. The "avalanche mode" silicon transistor is capable of an electrical switching operation in 1½ billionths of a sec. It can withstand temperatures up to 125C. **McGraw-Hill World News, Boston.**

A more stable copper price structure may prevail in the future than has existed in the past. By April, producers and fabricators should have rebuilt copper stocks to normal levels. Action of the copper industry then will foreshadow future production policies of the major companies. **What of the Coppers?, Monthly Letter, Goodbody & Co, January, 1960.**

Use of secondaries holds down system investment until demand gets very high, such as 24 kva per home diversified at the transformer. Even at 200-ft secondary spans, the "no secondary" system does not "prove in" until demands greater than 9.6 kva per home diversified at the transformer have been reached. It would appear that secondaries will be with us for a long time, unless the price of conductors and transformers changes in their balance of power. **Overhead Secondaries Still Are Economical, H. E. Campbell, Distribution, January, 1960.**



THE LINE 2A2 LUMINAIRE is the newest addition to L-M's complete line of mercury lighting. This integral-ballast fixture accommodates white, clear, or color-corrected mercury lamps through 400 watts, and can be adjusted for a choice of IES Types II, III or IV light distribution, and for high or low beam. Accommodation for photo control is also available.

L-M's New Line 2A2 Mercury Luminaire Has Self-Contained Integral Ballast For Low-Cost, Efficient Installation

Line Material's new integral-ballast Line 2A2 luminaire combines high lighting efficiency and fine photometric performance with functional styling and beauty. This latest addition to the L-M family of mercury luminaires is especially suitable for lighting residential and business streets, expressways, highways, white ways and shopping centers—wherever high lighting levels are desirable.

The Line 2A2 luminaires are distinctively modern in appearance. When mounted on their sweeping support arms, these new fixtures present continuous flowing lines that grace any area where they are installed.

The cast-aluminum body encloses the ballast, condensers, support-arm clamps, terminal block, lamp socket and reflector. The refractor is hinged and swings down, providing access to the lamp and reflector. The mounting clamps and the terminal block are accessible through a removable screw plate.

Fast Installation, Flexible Applications

L-M's Line 2A2 luminaire's "all-purpose" slipfitter permits mounting on either 1¼″ or 2″ pipe support arms. The specially designed clamps provide large contact areas that can not damage aluminum support-arm pipes. The luminaire is completely pre-wired with all connections brought to an accessible terminal block that lies in line with the incoming conductors. All Line 2A2 luminaires can be mounted and connected in minutes.

High-Lo Beam Adjustment

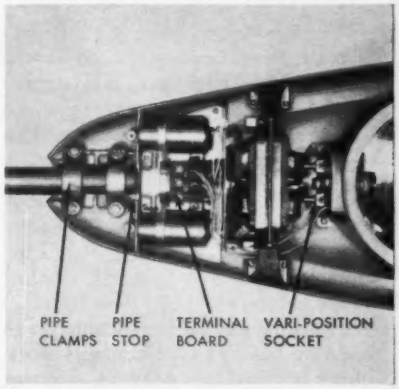
LINE 2A2 Mercury Luminaires incorporate an efficient Borosilicate Holophane refractor. The Vari-Position Socket permits a choice of IES Type II, III, or IV light distribution, and a *high or low beam* for maximum utilization. This new luminaire is available with accommodations for photo control.

The light unit is completely gasketed to seal out insects and dirt—dacron between refractor and reflector, fiberglas between lamp and socket.

Get Complete Information

Be sure you get complete information on the new L-M Line 2A2 Mercury Luminaire. Ask your L-M Lighting Engineer for Bulletin No. 59176, or write Line Material Industries, Outdoor Lighting Division, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw-Edison (Canada) Ltd., Toronto 13, Can.

L-M's NEW LINE 2A2 integral-ballast mercury luminaire is completely contained within a cast-aluminum body. The light assembly is gasketed to seal out insects and dirt; the refractor is hinged for easy access.



L-M's NEW LINE 2A2 luminaire is completely self-contained and pre-wired for quick, money-saving installation. All-purpose slipfitter accommodates 1¼″ and 2″ pipe support arms.

LINE MATERIAL Industries Outdoor Lighting

McGRAW-EDISON COMPANY

437

DISTRIBUTION TRANSFORMERS · RECLOSERS AND OIL SWITCHES · FUSE CUTOUTS AND FUSE LINKS · LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT · PACKAGED SUBSTATIONS · CAPACITORS · REGULATORS · OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS · PORCELAIN INSULATORS · FIBRE PIPE AND CONDUIT

McGRAW EDISON

NEW PRE-FAB SUBSTATION UNIT

New L-M Feeder-Pak® Provides Compact, Low-Cost, Low-Voltage-Side Unit

Shipped in pre-wired, assembled sections, ready for fast, economical installation in substation as complete 15 kv feeder unit.

by **W. V. SWAN**, Product Manager
Power Switching Equipment
Line Material Industries

The new L-M Feeder-Pak is a complete unit for the low-voltage side of a substation. It provides support for feeder conductors, disconnect and by-pass switches, lightning arresters, current transformers, and substation-type R or W three-phase Kyle heavy-duty recloser.

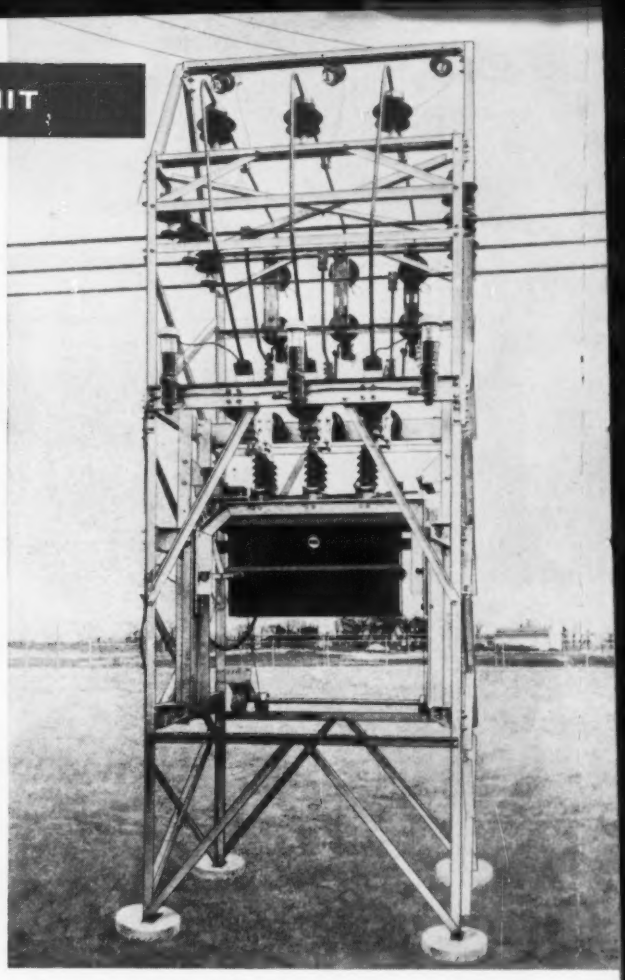
Neat, Compact

The unit has a very neat appearance. It is compact, easy to install. The whole unit comes in easy-to-handle crates. Additional units can easily be added when additional feeders are needed. Or units can be removed to other locations.

The Feeder-Pak costs about the same as the *materials* for a conventional open-type feeder position, but installation costs are far lower. Bus, insulators, switches, and arresters are all in place. No concrete pad is needed—only footings for the four legs. And it takes less land area—it's only 5 feet, 4 inches square!

Easy to Install

To erect the L-M Feeder-Pak, simply bolt the lower section to the concrete footings; set the upper section into the lower section and bolt; raise the recloser into position with the hoisting mechanism included in the lower section. Self-aligning bayonet-type contacts work automatically as recloser is raised into position. Automatic interlock prevents lowering the recloser until recloser contacts are opened.



THE NEW L-M FEEDER-PAK. The lower pre-assembled steel section contains the recloser, and recloser lifting frame and lifting mechanism. The unit is neat, compact. Base is only 5 feet, 4 inches square. It saves land, cuts installation and maintenance time. No mounting pad is required—just footings for the four legs.

L-M Feeder-Pak Features

1. With Kyle Type R or W recloser provides complete structure and equipment for low-voltage side of the substation.

2. Complete; compact; neat. Saves land costs; requires no pad; cuts installation man-hours.

3. Shipped as partly assembled units, crated for easy handling. Switches, arresters, and recloser disconnects are all pre-wired, and installed. Current transformers if desired.

4. Additional feeder positions are easy to add; or the Feeder-Pak may be removed to another location if desired.

5. Recloser lifting frame and tank lifting device make recloser maintenance safe and simple.

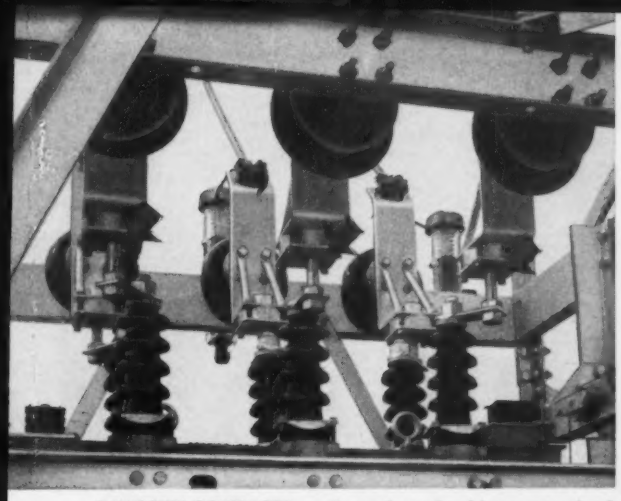
LINE MATERIAL® Industries
McGRAW-EDISON COMPANY

McGRAW EDISON

Substations and Power Switching Equipment®

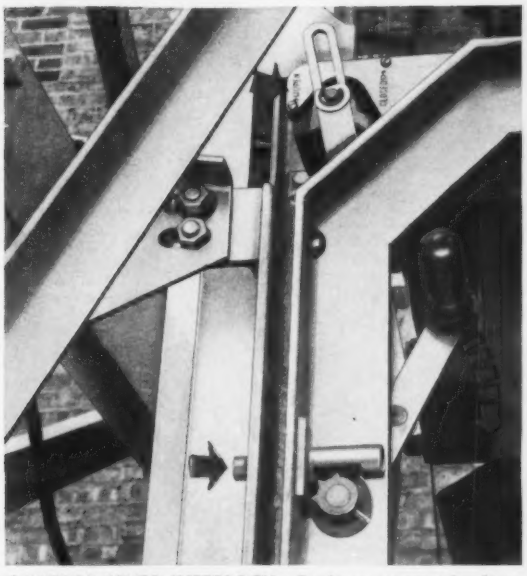
399

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

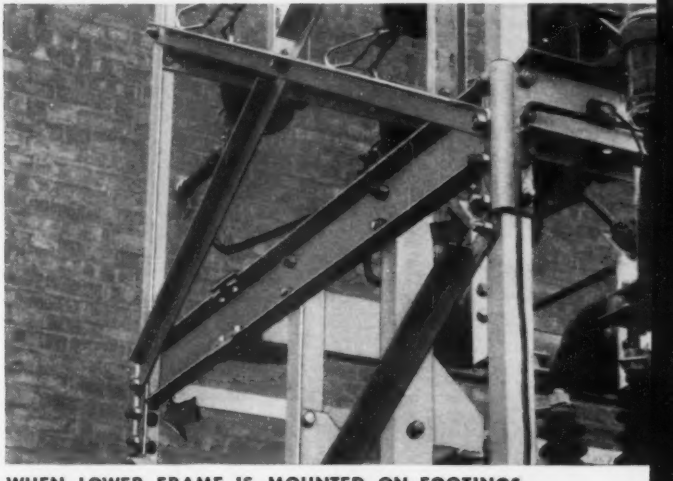


BAYONET CONTACTS on the recloser bushings are raised into the self-aligning automatic disconnects when the recloser is lifted into position. Thus connections are made safely, simply, and automatically.

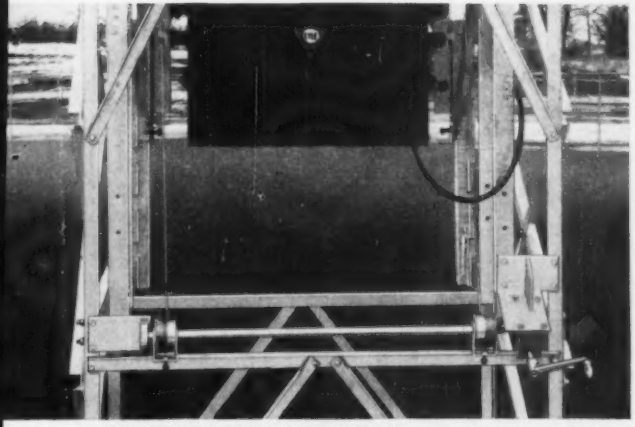
LINEMAN CLOSES BYPASS SWITCHES before lowering the recloser. These are L-M Type HXO heavy-duty fused switches. They are mounted on the frame and connected to the bus at the factory.



CONTROL LEVER INTERLOCK. Recloser cannot be lowered until recloser contacts have been opened by moving the handle down (arrow).



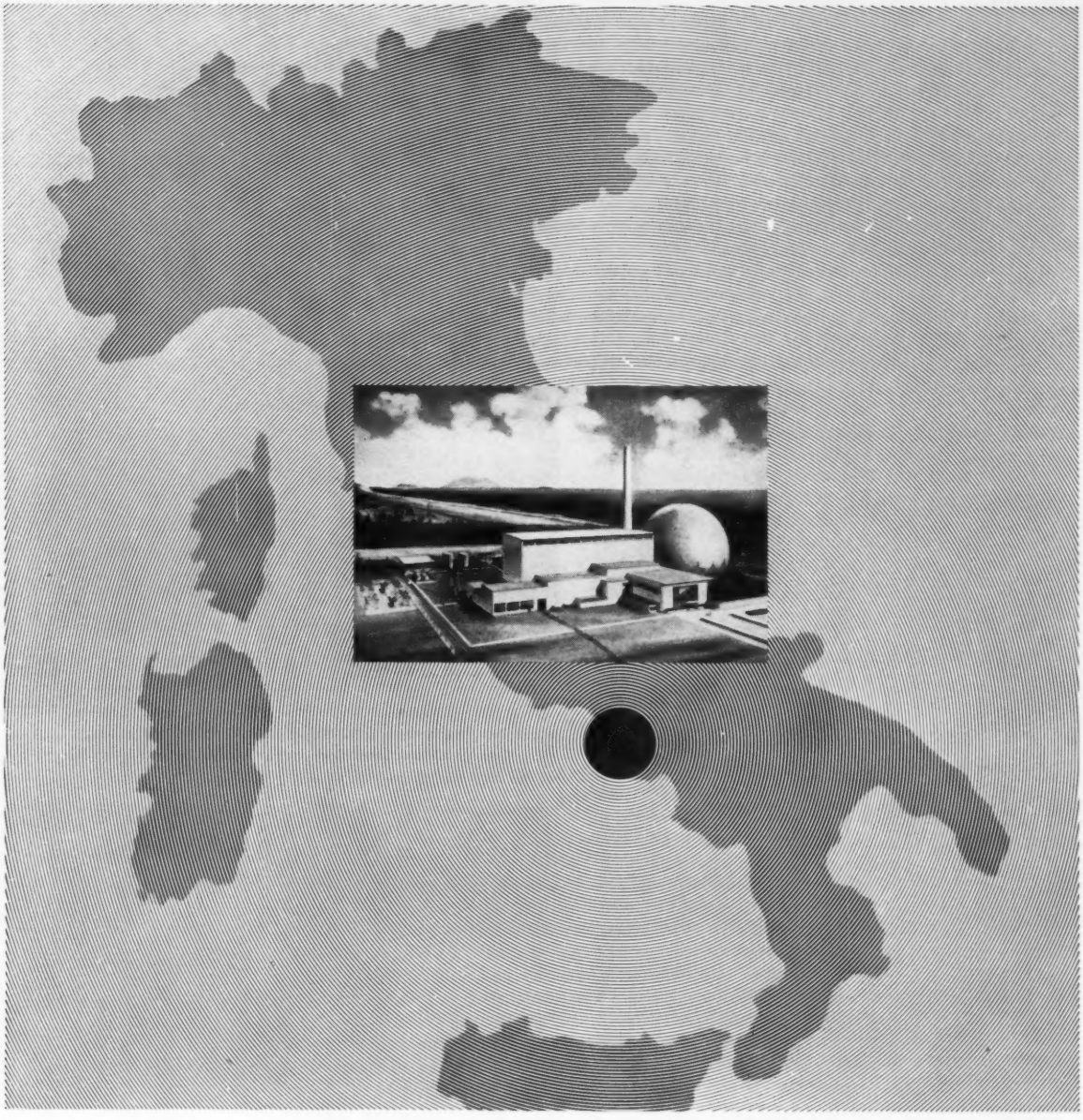
WHEN LOWER FRAME IS MOUNTED ON FOOTINGS, upper sections are simply mounted into position and bolted to the lower section at the corners. This is all it takes to assemble the entire unit!



RECLOSER LIFTING MECHANISM makes it easy to lower the recloser, and, if desired, to lower the tank to inspect the mechanism, change coils or time-current characteristics —which is easily and accurately done on Kyle reclosers— or for periodic oil change.

Get This Data on New L-M Feeder-Pak

Let us provide complete information on standard equipment and optional accessories. Then check your own present and proposed substation locations to see how this new L-M Feeder-Pak will save you money and man-hours, installation and maintenance. Talk to the L-M Field Engineer. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.



A new atomic power plant for Italy... the SENN plant near Naples. Engineering and construction is being handled by Ebasco. This project is backed by Ebasco's 54-year reputation for outstanding quality in diversified engineering and construction work.

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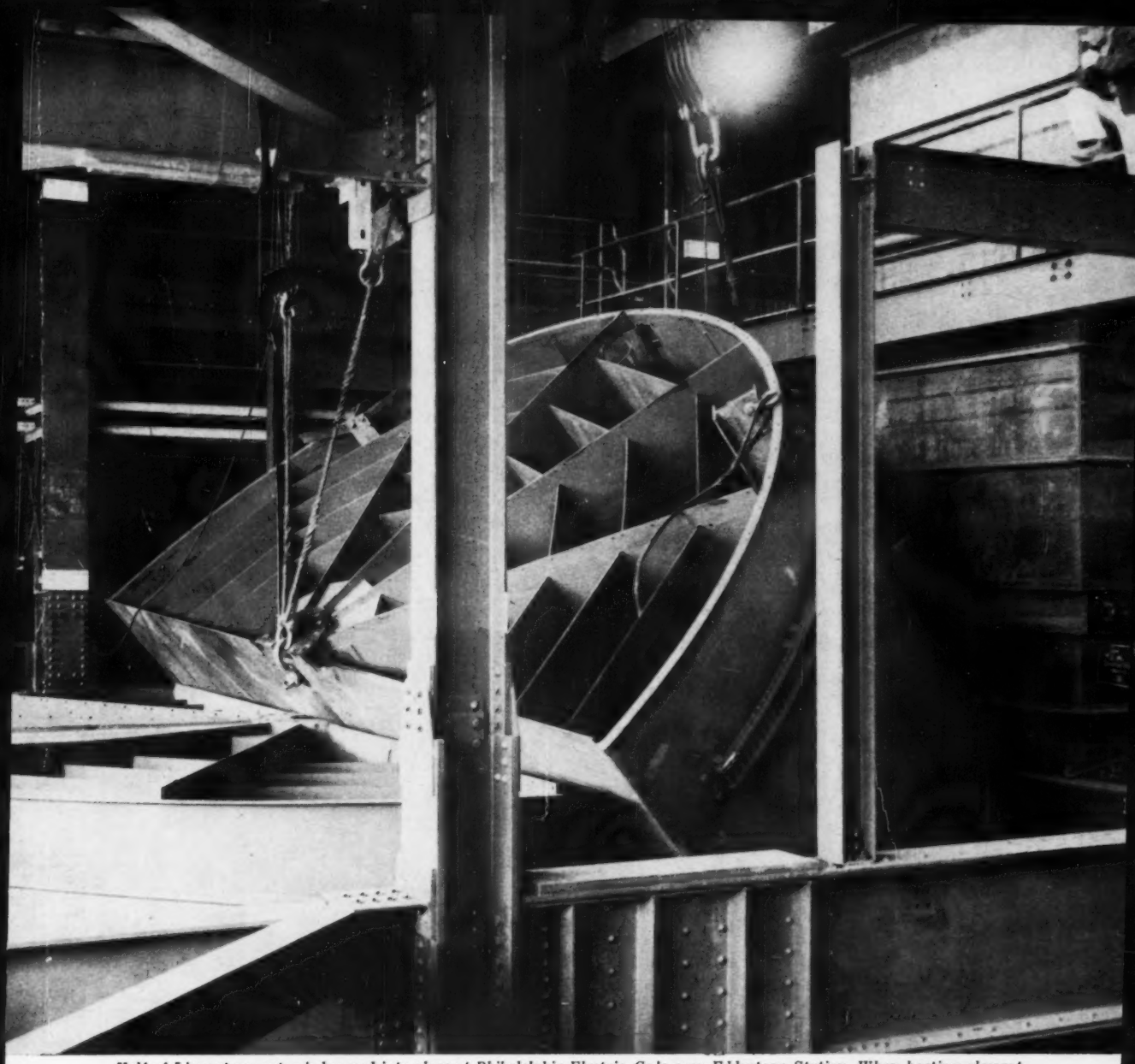

Half of Ljungstrom rotor is lowered into place at Philadelphia Electric Co.'s new Eddystone Station. When heating element baskets are fitted into the rotor chambers, this unit will provide 201,100 sq. feet of heat transfer surface and will weigh about 535,000 lbs. It will be one of four air preheaters serving a 325,000 KW unit. Two such boiler units are presently being installed.

SAFEGUARDING EDDYSTONE'S **NEW LJUNGSTROMS®** **—LIFETIME AIR PREHEATER SERVICE**

Dependability is standard equipment in Philadelphia Electric Co.'s new Ljungstroms. Each unit is protected by Lifetime Air Preheater Service. That means that *throughout the life of each unit*, Air Preheater engineers make regular calls to inspect the Ljungstroms and keep them in top operating condition.

Air Preheater also shows lively, consistent interest in their *factory* service to customers. For example, when a midwest customer recently ordered emergency replacement elements, Air Preheater's traffic department investigated the cost, speed and control of all commercial shipping methods. In the circumstances, regular trucking would take too long, rail delivery was impractical, other methods prohibitively expensive.

So Air Preheater asked for authorization to ship the replacement elements aboard one of their own trucks. The result: the elements arrived a week in advance of the hoped-for date – and, thanks to Air Preheater's efforts, the customer made significant savings on transportation costs.

In addition to regular field service and fast, competent factory service, Air Preheater offers you over 35 years of experience in solving boiler and preheater problems. These reasons help explain why 19 of the 20 most efficient power stations in the U.S. are Ljungstrom-equipped.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

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10
Standard

MEANS INCREASED REVENUE

• Now the advanced design features of the Standard type SWA low impedance distribution transformer put the power at the meter by radically cutting losses . . . EVEN AT PEAK LOAD. This increased transformer efficiency gives you three-way profit . . . fewer customer complaints about service . . . better voltage at entrance switch . . . more of manufactured energy metered . . . and increased return per kwh produced. Copper losses alone have been cut as much as a whopping 30% at full load! What would that mean on your system?

Load-building to meet peaks brings on another problem met head-on by the SWA—overload. With the Standard SWA, improved thermal time constant permits overload without excessive heating or excessive voltage drop. You have fewer burnouts . . . fewer costly changeouts.

This is the greatest advance in distribution transformer design and efficiency since the introduction of grain-oriented steel. It was FIRST AT STANDARD.

Your nearby Standard representative can show you what the all-new SWA means on your complete system or on any division of it. Get the facts from him today.

WRITE FOR Standard Bulletin S-401-C. It gives complete information on the SWA and shows how it will help increase your revenues. We'll send it by return mail.

40 years of concentration on transformer design exclusively

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Standard Transformer CO.

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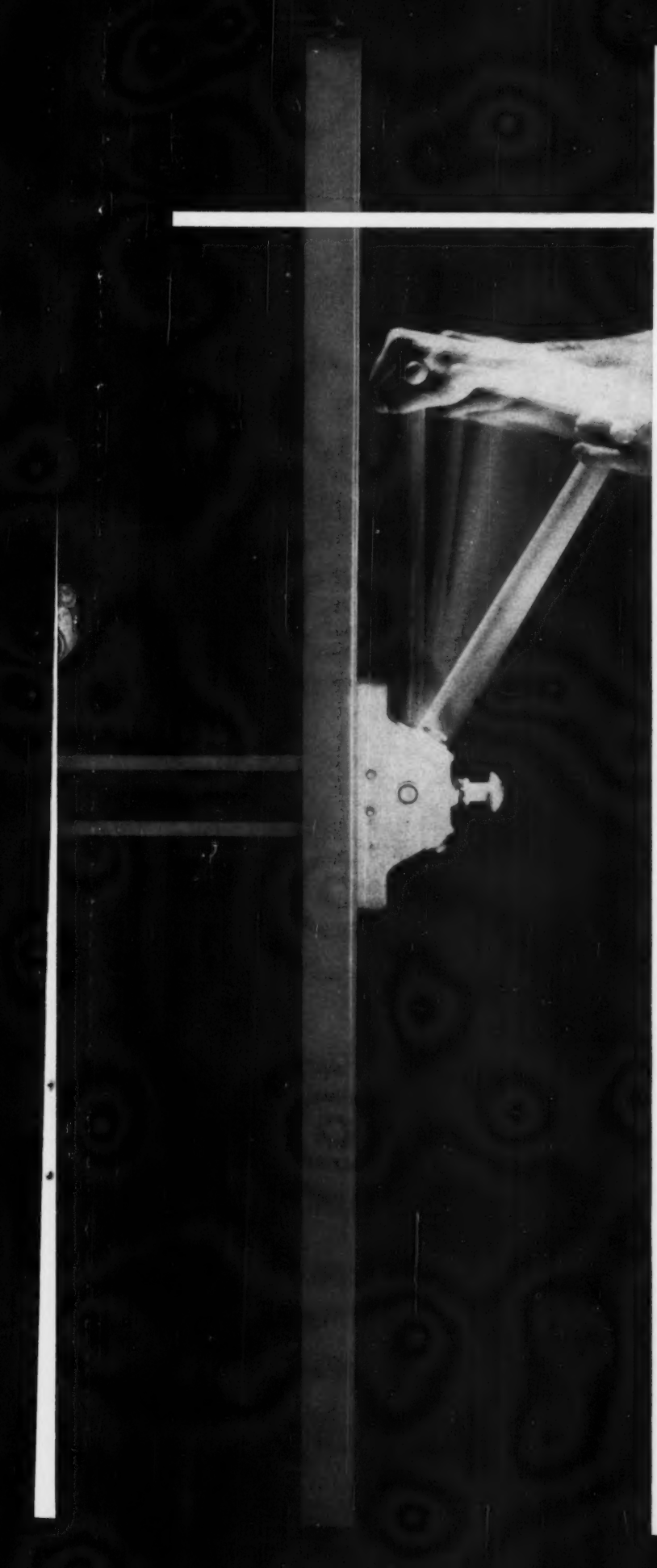
"WHEREVER THERE IS POWER"

FAULT CLOSING

S&C metalclad switchgear meets all requirements of new National Electric Code for fault closing, short-circuit interruption. Performance proved by high power testing at KEMA laboratories.



S&C metalclad switchgear can close on any fault up to 60,000 amps

No danger to equipment—no danger to operator even if he closes load interrupter switch on the heaviest faults. S&C's new line of metalclad switchgear is rated as high as 44,500 amps fault closing, 500 mva short-circuit interrupting at 14.4 kv. And at 4.16 kv, the corresponding ratings are 60,000 amps, 250 mva!

Here's how it works: 1) Fault never flows through interrupting unit when switch is closed . . . it flows through separate arcing contacts; 2) Arcing is minimized and magnetic forces are overcome by quick-make, quick-break toggle action no matter how slowly operator closes handle.

Short-circuit interrupting duty (up to 500 mva) is handled by a new boric acid power fuse, the Type SM, which features multiple bore construction to handle low, medium, and high faults.

The simplicity of the S&C design—power fuses for short-circuit interruption and load interrupters for manual or automatic load switching—enables you to save as much as 50 percent on your switchgear investment. Why not consider S&C Metalclad Switchgear for your high voltage power systems? In industrial plants and commercial and institutional buildings there are rarely any transient faults, so there is no real need for the automatic reclosing ability of the more expensive circuit breaker type of switchgear.

For more information please consult the telephone directory for your nearest S&C sales office.

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Specialists in High Voltage Circuit Interruption since 1910

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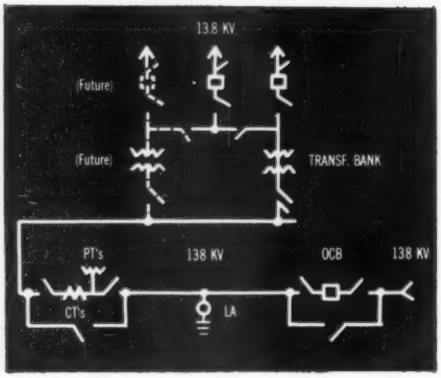
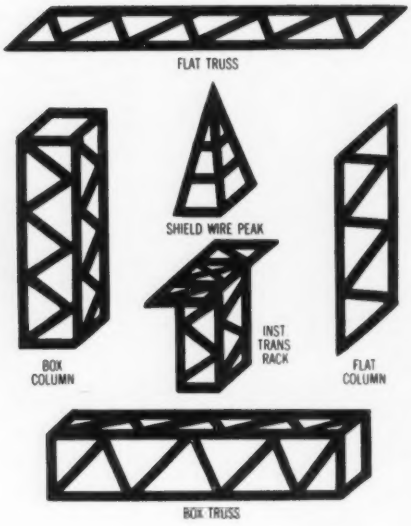
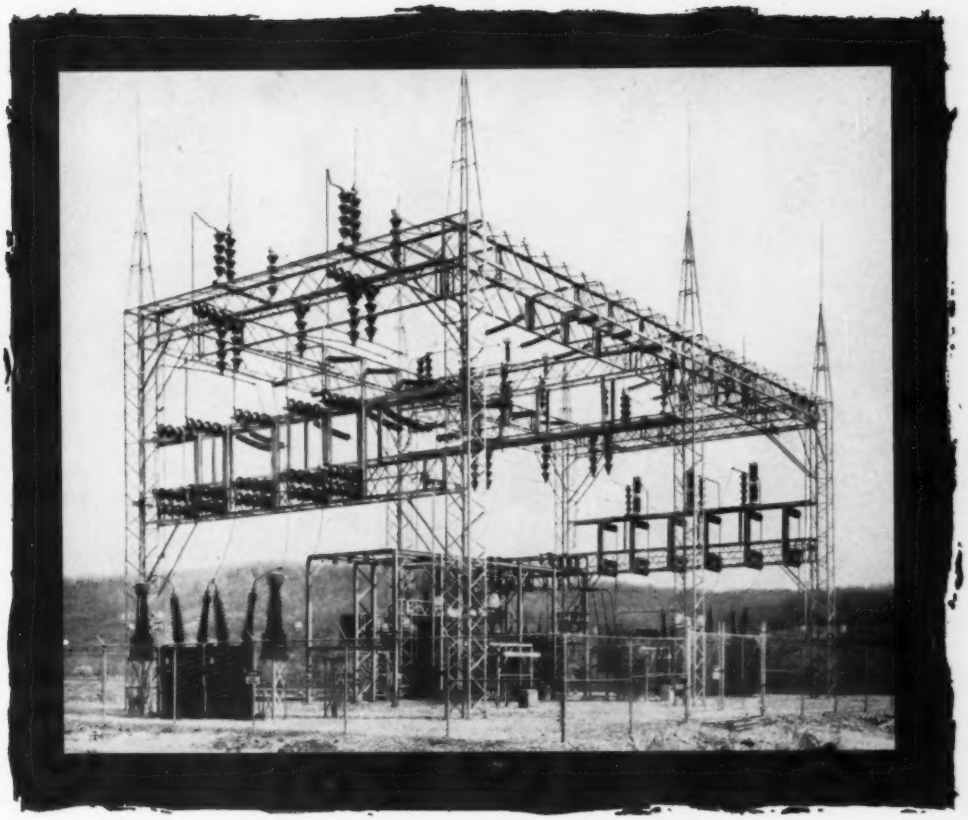




NOW... LET WESTINGHOUSE STANDARD STRUCTURAL COMPONENTS REDUCE YOUR OUTDOOR SUBSTATION COSTS... A few standardized components permit an unlimited variety of lower cost station arrangements. **Save your design time . . .** just send us the station diagram and Westinghouse will design your substation with standard components.



ADDITIONAL ADVANTAGES: 1. Outstanding Product Integration . . . structure designers coordinate with equipment designers for single-manufacturer responsibility and single-order coordinated delivery. **2. Efficient Use of Steel . . .** maximum strength with minimum weight through proper choice of predesigned components. **3. Simplified Field Assembly and Erection . . .** all components use interchangeable members—a few bundles of steel instead of many. **4. Uniform Structural Components . . .** give clean, uncluttered appearance to the complete station. Compact design requires minimum plot area.

Investigate this complete Turnkey Plan. Westinghouse assumes full responsibility for the satisfactory operation of the complete substation. Ask your Westinghouse sales engineer for all the facts, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60992

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All suspension insulators and hardware are designed to work together.

But good design is only the beginning. Unless that design is faithfully reproduced in every part of every piece - - porcelain and metal - - the designed strength will never be fully realized.

At Ohio Brass we've been making porcelain for over half a century. We've been making our own metal components - - in our own foundry - - even longer. Here porcelain and metal aren't just designed for each other, they're *made* for each other.

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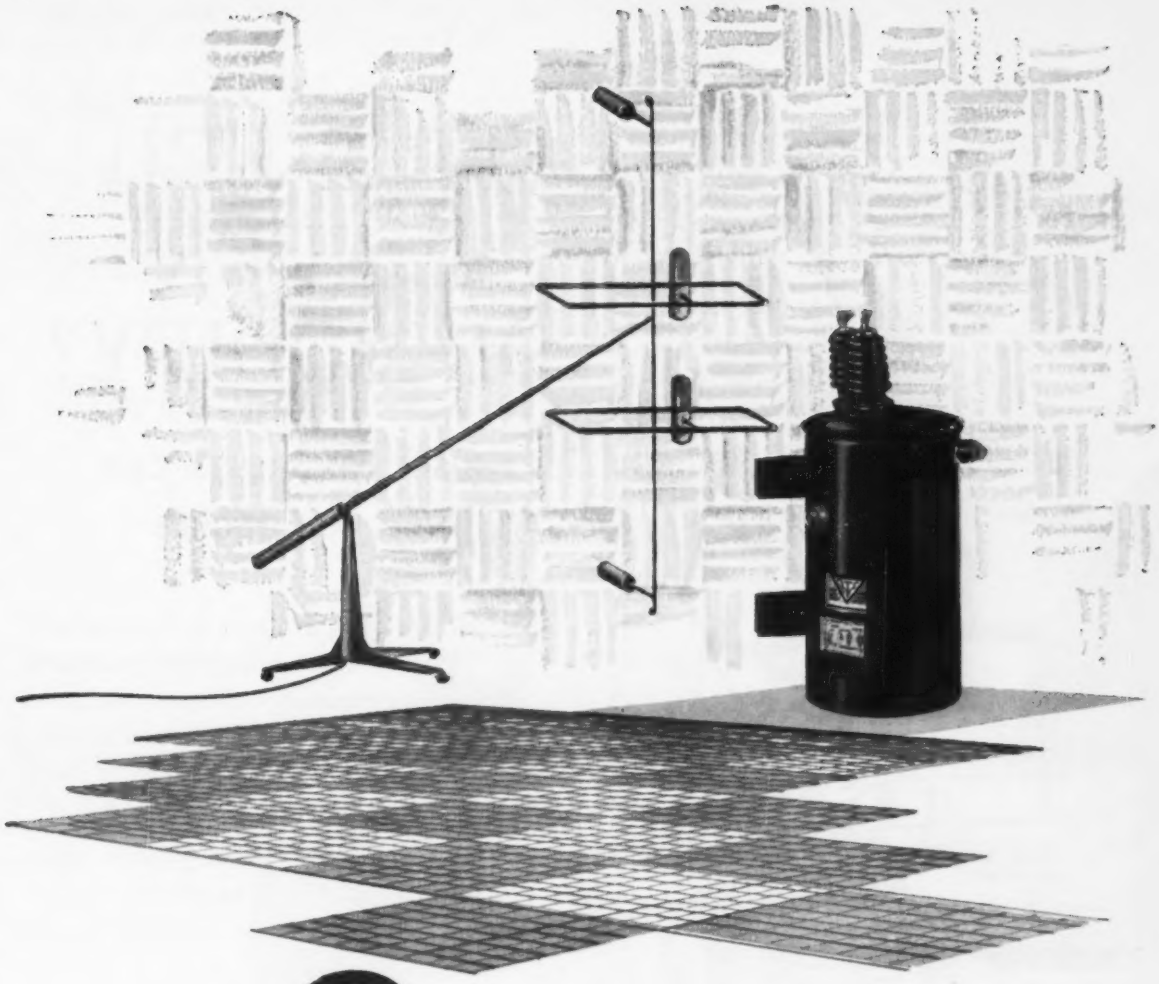

QUIET transformers assure satisfied customers. More-than-ordinary quietness is another outstanding feature of RT&E transformers. Normal noise is hushed, for full transformer life, by a unique core-clamping method that isolates the core and minimizes the transmission of sound vibration to the tank. By this method, operating noise is reduced to a point far below maximum db levels being considered by NEMA as standard for distribution transformers.

More proof that you buy more than just another transformer when you buy from RT&E.

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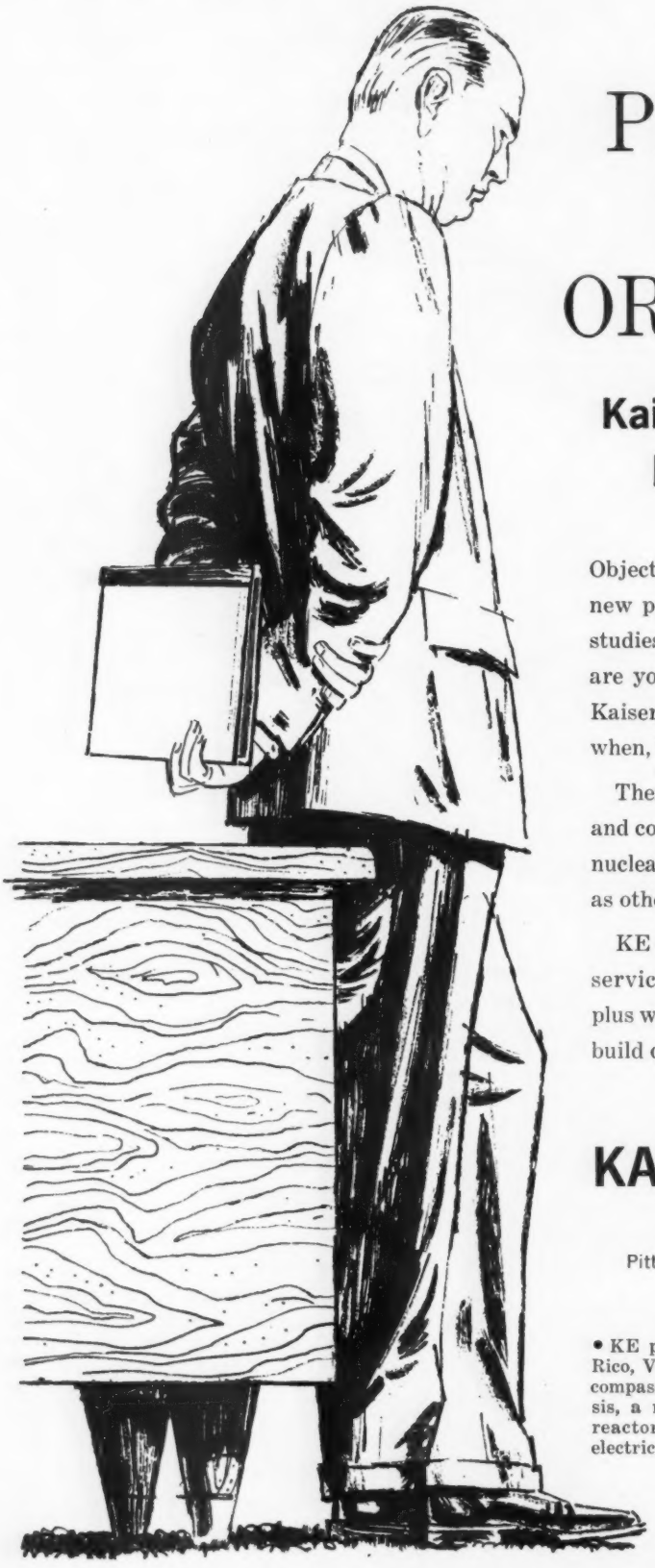

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Kaiser Engineers can help you decide

Objective analysis is vital to sound decision on new power generating facilities. Feasibility studies, economic analyses and site evaluations are yours by an outside, impartial firm when Kaiser Engineers is selected to help you decide when, how and where to proceed.

These services are in addition to the design and construction of all types of power plants—nuclear, fossil fuel and hydro-electric—as well as other nuclear facilities.

KE offers complete, one-company, integrated service from concept through construction—plus world-wide experience and the ingenuity to build quickly, within budget.

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• KE projects include work in Ghana, Japan, Puerto Rico, Vietnam, as well as the United States. They encompass such diverse assignments as nuclear fuel analysis, a nuclear research center, plutonium production reactor, steam-electric power station and a hydro-electric plant.

5458-P

U. P. GENERATING COMPANY FOUND A WAY TO BE SURE OF CHOOSING THE RIGHT TURBINE OIL

They selected NONPAREIL —the only oil with life-of-turbine guarantee

Situation: In 1955, Upper Peninsula Generating Company installed a 22,000 kw General Electric turbine in its Presque Isle station. When lubricant for this turbine was chosen, U. P. management elected to install an oil with a life-of-turbine guarantee—NONPAREIL.

But that wasn't all plant management received when the decision was made to buy NONPAREIL Turbine Oil. In addition, Duane Johnson, Standard Oil lubrication specialist located in Marquette, made a complete lubrication survey of the entire plant. He provided technical service on lubrication during construction and after operations started.

What has happened: In the four years since installation, the turbine has performed satisfactorily without any lubrication difficulty. In a routine inspection a year after installation, the bearings proved to be in excellent condition. Periodically samples of the oil have been removed for analysis at Standard Oil's Whiting laboratory. The oil remains in its original excellent condition.

What you can do: Get this life-of-turbine guarantee on the turbine oil you install by specifying NONPAREIL. Call the lubrication specialist in the Standard Oil office near you anywhere in the 15 Midwest or Rocky Mountain states. Or contact **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

You expect more from STANDARD *and you get it!*

Standard Oil lubrication specialist Duane Johnson (left) and station chief engineer Charles York, inspect 22,000 kw G-E turbine at Presque Isle station. On lubrication jobs of this kind Duane Johnson is well qualified to provide technical service. He has an engineering degree from the Michigan College of Mining and Technology plus 10 years' experience with Standard in this work. He has also completed Standard's Sales Engineering School.

Quick facts about

NONPAREIL
TURBINE OIL

- Will not permit formation of harmful acids
- Will not permit formation of sludge or oil varnish
- Will maintain good demulsibility or water-separating characteristics
- Has high resistance to foaming
- Contains adequate rust inhibitor

THE SANGAMO P-3 GIVES ALL THE BENEFITS OF... THREE STATOR METERING

WITH THESE PLUS FEATURES:

		P3	Other 3-stator meters Type X	Type Y	Type Z
APPLICATION	Complete Line	Yes	No	No	No
	Continuous Capacity (Amps)	200	150	175	150
	Least Switchboard Space	Yes	No	No	No
DESIGN	Number of Disks	1	2	2	3
	Smallest Size	Yes	No	No	No
	Minimum Weight	9 lbs	17 lbs	18 lbs	12 lbs
TESTING	Number of Adjustments	8	10	11	12
	All Micrometer Adjustments	Yes	No	Yes	No
	Easiest to Test	Yes	No	No	No
ACCURACY	Disk Speed (Rpm.)	8⅓	30	16⅔	30
	Lowest Starting Watts	Yes	No	No	No
MAINTENANCE	Sectionalized Construction	Yes	No	No	No
	Cover Replacement Cost	$2.56	$3.71	$10.25	$7.05

Sangamo has developed this three-stator polyphase meter to meet the measurement problems created by today's large loads. The P3 is the smallest, lightest three-stator meter made . . . the only one with single disk, round cover, modern design. It is a slow speed meter. And, it is the only three-stator meter with full 200 ampere capacity. Fill your three-stator metering requirements with Sangamo's complete line of P3 Meters (Class 10, 100, and 200 in socket and bottom-connected construction).

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

JH60-2

Editorial Comment

FEBRUARY 22, 1960

Company-Co-op Cooperation Needed at Local Sales Level

In a number of activity areas, the time has come for investor-owned utilities and rural electric cooperatives to discard their boxing gloves and adopt a policy of active, local-level cooperation.

Such cooperation must promise high mutual benefit without compromising basic philosophies on inequities between the two types of utilities. A number of areas readily meet these specifications.

The one offering greatest gain for least money and effort is farm sales promotion. This is where cooperation should start. In small degree, it has begun, at least on a national level. The Inter-Industry Farm Electric Utilization Council has done yeoman work in bringing companies and co-ops face to face with the situation.

But to be significant, the effort must spread to the local scene, with individual companies and co-ops working together freely and actively. There has been little action along these lines.

According to EEI's Edwin Vennard, "The big investment in bringing service to individual customers is now largely completed. The task from now on is to increase utilization of farm service. We know that on a per-unit basis, costs will drop as we do so." Farm load is good load, with higher than average load factors. The territory is unexploited, and begs for sales impact.

Vennard feels local sales programs, designed and operated mutually by companies and neighboring co-ops, are the answer. NRECA Pres Walter Harrison has voiced approval of company-co-op teamwork in this area. Vennard and Harrison represent national groups. Their approval is influential, but local follow-up is mandatory.

We believe farm sales is but one area where cooperation can be mutually beneficial. To mention others, mutual planning and interaction on maintenance, safety, and employee training offer perceptible gains.

But we'd like to see farm sales promotion get the first really big push at the local utility level.

And Speaking of Cooperation . . .

Few, if any, industries can boast of a cooperative effort that encompasses companies representing 96.5% of the industry's capacity and 87.6% of the industry's customers. Yet this is the industry-wide cooperation rendered this year in Electrical World's annual survey of electric utility construction and expenditures. Furthermore, this year's response is typical.

Statistically speaking, a survey return of 18-20% is considered average and any reaching near 50% is exceptional. And the EW survey form is a complex one, which takes time and effort to complete.

Apparently there's good agreement that cooperation here is well worth the effort. The result is publication of a very accurate barometer of industry expansion plans. It serves first as a guide to individual utilities. Also, it aids evaluation by the financial community, and helps suppliers schedule production for the good of their customers.

We thank each individual who contributes to this annual effort. And we appeal to that hard-core minority that has never contributed, to make next year's survey 100% representative.

U.S. Power Men Answer:

- Why did you go to Russia?
- How did you come to write your power study?
- Did you get facts or propaganda?
- Can Russia outstrip the U. S. in power production?
- Can Russia meet goals of the seven-year plan?
- In what areas of technology do Russians excel us?
- How far along are Russians in atomic power?
- How serious is the drive to raise living standards?
- Is there cyclical buying of heavy power equipment?
- What incentives do Russian engineers have for improving power technology?
- How long is the work week?
- Do the Russians tell a different story at their fairs and exhibitions?

FRANCIS K. McCUNE, engineering services vp, General Electric Co

Iron Curtain Raised to Reveal

Last week the Edison Electric Institute published a comprehensive study of USSR electric power development (see review on page 45) based on information amassed by some 15 top U. S. power men during tours of Russia over the past two summers. To provide our readers background of the EEI study and some personal impressions of four of the men who helped author it, Electrical World editors recently sat down with Edwin Vennard, managing director of EEI; Francis K. McCune, a vice president of the General Electric Co; Charles E. Eble, president of Consolidated Edison Co; and Harvey E. Bumgardner, assistant to the president of The Detroit Edison Co. The following questions and answers contain the conclusions gained from the three-hour joint interview:

• Why did you go to Russia? How did these trips come about?

Bumgardner: The trips were part of a technical and cultural exchange program arranged by the State Department and its Russian counterpart. The Russians desired an exchange of information and inspections with the members of our industry. Our State Department got in touch with Walker Cisler, president of Detroit Edison. Cisler assigned me to handle details. As you know, I am chairman of the EEI technical exchange program and have helped arrange programs for many overseas electric power delegations visiting this country.

We submitted a proposed itinerary well in advance of our first tour, requesting travel in European Russia as well as in Siberia and the Ural Mountains. There was only time to visit European Russia during our first visit. On the last day of that first visit, we were told that permission had been granted to visit the two other regions. Our leader, Walker Cisler, informed the minister of power that we would be glad to return the following year to complete our exchange visit. This we did in the summer of 1959, when, at Mr. Mikoyan's suggestion, Armenia was added to our itinerary.

• How did you come to write your report?

Vennard: Our purpose was, of course, to provide an up-to-date reference work on Russian power systems. Everyone kept copious notes during their inspections and interviews with administrators and engineers in Russia. When we arrived back in the U. S., each of us sat down and transcribed those notes. All notes were then sent to EEI headquarters for assembling into a single volume. In addition to our notes, we had gathered a great many Russian books, reports, and other papers. We turned the material over to a staff of engineers, economists, and writers for the difficult job of editing.

HARVEY E. BUMGARDNER, Detroit Edison, heads exchange program

CHARLES E. EBLE, president, Consolidated Edison Co of N. Y.

EDWIN VENNARD, vice president and managing director of EEI

Score on Russian Power

• Did you get facts or propaganda?

Vennard: We all felt that we received reliable information from the engineers. In every way that we could check, the information proved out. When they claimed that they had installed 5.5 million kw last year, we accepted that as possible and probable. When you consider that we installed more than 15 million kw of capability last year, their claim of installing 5.5 million seems too modest to be propaganda.

Eble: There was always the indication they were serious. Nor did the Russians appear to duck any questions. If the top officials at the locations we visited lacked certain information, they sent for it and gave it to us later.

McCune: The men knew what they were talking about and gave every evidence of exerting the authority which they claimed. When I asked detailed questions about the control rods and the sheathing of a pressure vessel, they came up with precise and believeable answers.

• Can Russia outstrip the U. S. in power production?

Vennard: The answer to this question requires an opinion as to whether the total productive capacity of Russia will outstrip that of America—in the foreseeable future.

It can be assumed that in each country sufficient electric power capacity will be provided to meet the needs. Building power capacity in excess of actual needs will not in itself increase the total production of either the Russian or the American economy.

Some people have taken recent trends in Russia's consumption of electricity to indicate that Russia will pass America. This is an erroneous conclusion. Russia's rate of consumption of electricity in recent years is influenced first by increased customers and increased use per customer. America experienced this kind of growth during the Twenties.

Russia's recent trend is also influenced by the fact that Russia is spending a relatively high percentage of its gross national product in the building of war material. America had a similar trend during the years 1938 through 1945. This does not mean that expenditure for this purpose is good for the economy. On the contrary, it is not. Such expenditures are not good for a nation's overall economy as they do not produce consumer goods or services. Only the production of consumer goods and services contribute to improvement in living standards.

A controlled economy can order the building of an industrial machine for war purposes and can order the power facilities built to serve it. However, the building of industrial production for consumer goods presents a different problem in that consideration must

be given to the purchasing power of the people to absorb the goods.

If Russia continues to expand production of war material, it must inevitably do so at the expense of living standards. In its efforts to improve the standard of living of the people, Russia has indicated a desire to level off war production and increase the production of consumer goods. Some progress is being made.

I do not believe that the Russian productive capacity will equal ours, nor will the Russians equal us in electric power.

• Can Russia meet the goals of its seven year plan?

Vennard: We saw nothing to indicate that Russia cannot meet its goals for the expansion of power production under the current seven-year plan. After all, their goal of 110 to 112 million kw by 1965 means the addition of only some 9 million kw per year during the period—a rather modest program.

McCune:Certainly if the Ministry of Power Station Construction gets the money, it can build the capacity. There were no deficiencies in manufacturing that I could spot which would keep them from reaching their goal. They are working hard to get more power transformer capacity and said several times they would like to buy this kind of equipment from the U. S. Also the fact that they have shipped turbine generator sets outside the country and now are making several large machines for Egypt and China would indicate they have the capability to produce the machines needed. I doubt very much that Premier Nikita Khrushchev would give any of the ministers or deputy ministers an "E" for effort if such machines were shipped out of the country at the expense of satisfying Russia's own needs.

Eble:I certainly wouldn't want to sit here and say that the Russians couldn't meet their power goals. Everything I saw would indicate they are perfectly capable of doing so. But I reiterate that these goals are modest.

• In what areas of technology do the Russians excel us?

Vennard: As far as I could see, they are ten years or more behind us in most areas of technology. The largest steam generating unit that the Russians have in operation is about 200 Mw—a size that we had in operation 30 years ago. They are, for the most part, plowing ground that we have already plowed. But I don't want to leave you with the impression that the Russians are not smart. They are good engineers and good scientists.

McCune: I would go along with that pretty much. On the other hand, I would be interested in the technical data on their 800-kv, dc transmission line from Stalingrad to Donbas. The design of the terminal equipment would be especially interesting. Of course we have several EHV projects going on in this country, but still we could learn something from their data, particularly on dc transmission. Their top ac transmission voltage is 500 kv. This is higher than ours, but the technology is little different from EHV transmission practice here.

• What about hydro technology?

Vennard: Russia has built a number of large, spectacular dams. The 2.3 million kw project at Kuibyshev and the 4.5 million kw project now under construction at Bratsk are examples. These dams are well-constructed and efficient, but there is nothing about their construction that we don't know. Russia likes to do the spectacular. People talk about these big dams and forget that America now has three times the hydro capacity of Russia. As recently as 1958 only about four percent of the average annual capacity of major Russian rivers was being exploited. Moreover, the Russians are planning to deemphasize their program of hydroelectric construction. Construction of steam stations is to be emphasized in order to produce more electricity in less time and with less capital required. We were told that by late 1965 about 85% of their electric power will be produced by thermal stations and 15% by hydro stations. The ratio is now about 80% steam and 20% hydro, just about the same ratio as in this country.

• Do the Russian have our big problem of cyclical buying of heavy power equipment?

McCune: Not quite! But they have their own version of the problem. There may occasionally be lags in planning. When we visited the Novosibirsk Generator Works last July, they did not appear busy. What may have happened was that they were tooling up for producing the 225-Mw machines for the Bratsk hydroelectric development. There will be 20 generators in that one station, and the first four are scheduled to be in operation next year. So I suppose you do have a cyclical variation in their plants similar to but less drastic than our cyclical buying problem.

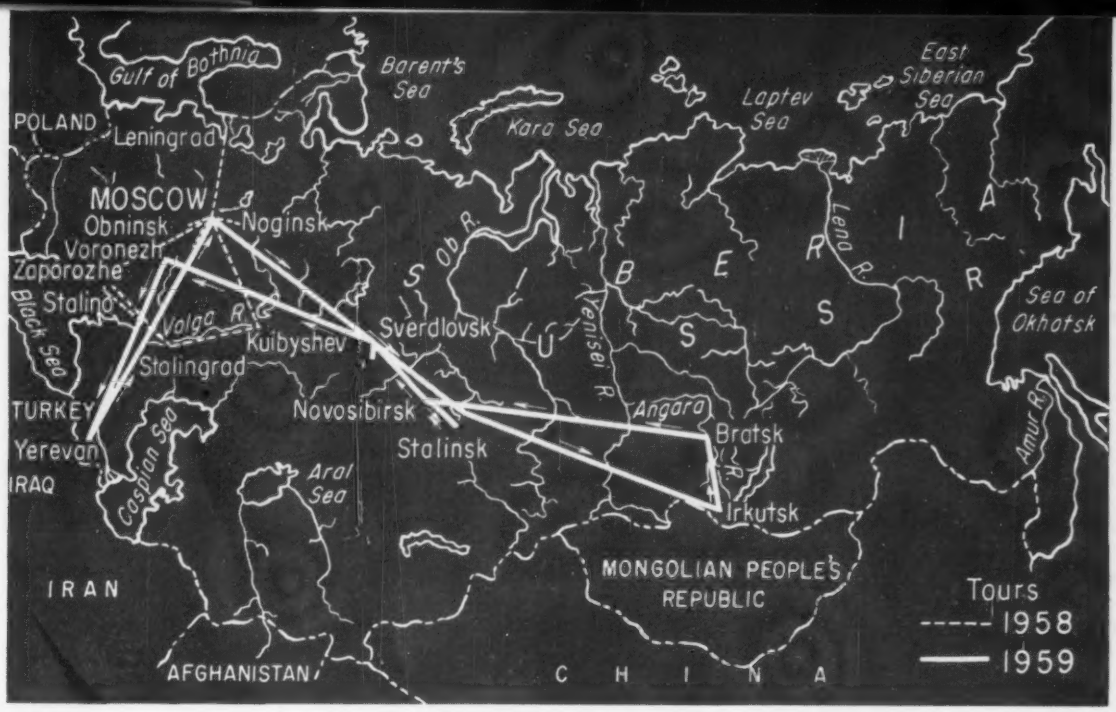
• What incentives do Russian engineers have for improving power technology?

McCune: They do have a system of incentives designed to encourage hard and imaginative work. As much as possible, their incentive system attempts to recognize quality as well as quantity.

• How serious is the drive to raise living standards in Russia?

Vennard: First, we should point out that the average worker in Russia has an income of about one-third as much as the average worker in the U. S. Average residential consumption of electricity in the USSR is about 400 kwhr per year compared with an average of 3,550 kwhr per residential customer in the U. S. last year. But efforts are being made to raise the standards of living in Russia, even though much of the power use and production is still going into heavy industry.

McCune: I think about the best indication of the emphasis being put on higher living standards is the fact that many of the 24 ministries are charged solely with this task. As far as we could see, they are taking this responsibility seriously. They know that this can be accomplished only by increasing production—mechanizing. And that means farms as well as industrial tasks. Today some 42% of the Russian workers are engaged in farm work. We're able to feed our people and accumulate vast surpluses with less than 12% of our workers on the farm.



After two tours of Russian power systems, U. S. electrical industry team . . . .

Report Finds Soviet Sound on Power

The U.S. power teams that toured Russia in 1958 and 1959 have compiled a report on USSR electric power developments that stands, today, as the most readable book available in the U.S. on Soviet power industry. It's arranged so those interested only in the "big picture" don't have to plow through a mass of detailed observations. Yet, statistical data and specific technical observations are still there.

Today, the Soviet power industry stands second only to the U.S. At the end of 1958 its capability was 53 million kw. This is way below the U.S. capability of 167 million, at the end of 1958, but it's still 12% of world's power capability.

But how good is Soviet power system engineering? Are their facilities well built? Can they meet their announced power goals? Can the U.S. hold its lead?

The U.S. team report adds it up this way:

- The Russians have shown their technical competence in the field of electric power.
- In engineering and construction of power facilities, they are doing an able job today.
- Turbines and generators made in Russian plants appear to be well manufactured.
- Research facilities in Russia are generally good.

Knowing this, it would be safe to assume that the Soviet is technically able to reach its goal of 110 to 112 million kw of capacity by 1965. But, even if it reaches this goal, the report points out that the U.S. will by then have a capability of 245 million kw and the 124 million kw gap between U.S. and Russian capability will have widened by 10 million kw.

Steam plants in Russia, says the team report, are increasing in size and number. In 1958 they had 11 plants of 500 Mw or more and 109 that had 100 Mw or more capacity. Turbine-generator unit sizes, too, are growing; in 1957 56 units of 100 Mw and three of 150 Mw were operating. In 1958 units of 200 Mw were in manufacture. Nearly 60% of steam plants in service in 1958 used steam at 1,420 psi and 930 F. Fuel rate is dropping but hasn't caught up with the U.S. In 1957 it was 1 lb per kwhr, and in 1958 about 0.97, compared with U.S. rates of 0.93 and 0.91.

High-voltage transmission is where the most interesting Russian technical work is being done. It reflects their past emphasis on hydro and their need to transmit power from remote sites, to load centers. In 1958 Russia had 2,600 miles of 400 kv. Today an 800 kv dc line is being built to carry 750 kw 300 miles. Russia already has 10 years experience with a 70-mile 200 kv dc transmission line from Kishira to Moscow. Work is progressing on conversion of a 550 mile 400 kv ac line to 500 kv; a step that will boost its capacity 25 to 35% at a 4% increase in capital cost.

Atomic power is still in the research and development stage, in Russia as it is in the U.S. Many types of reactors are being explored. Like us, the Russians feel a way will be found to make economical power from atomic fuel. Plants being built are to provide information, not economic energy. Right now three new atomic plants are building. One of 210 Mw at Voronezh, another of 200 Mw at Beloyarsk, and a third of 50 Mw tank-type BWR at Ulyanovsk. In late 1958 Russia announced operation of a 100 Mw atom plant at an unspecified Siberian location. Earlier in 1958 they announced operation of the "world's first" atomic power plant, a 5,000 kw installation at Obninsk.

Federal Jury Indicts Five Firms, 18 Persons

Grand jury returns three indictments in probe of electric companies' pricing policies. Defendants, utilities comment

The Philadelphia federal grand jury looking into the pricing policies and practices of electrical manufacturers returned three criminal indictments last week against five companies and 18 individuals within those companies.

The five firms indicted were Allis-Chalmers Mfg Co, Federal Pacific Electric Co, General Electric Co, I-T-E Circuit Breaker Co, and Westinghouse Electric Corp. Three other firms—Moloney Electric, McGraw-Edison Co, and Wagner Electric—were named as co-conspirators, but not indicted.

The three indictments involved: (1) Power switchgear assemblies; (2) Oil and air circuit breakers; and (3) Low-voltage power breakers. Total sales of the products: About $209 million a year.

Indictments Charge 'Price Fix'

All three indictments charge the defendants with conspiring "to fix and maintain prices," among other things. The indictment, for example, relating to power switchgear sets forth the various actions taken by the defendants to carry out the alleged conspiracy. In addition to various meetings held throughout the country to discuss prices, the indictment charges that defendants met on at least 35 occasions from November, 1958, to October, 1959, to allocate bids to government agencies, so as to provide each manufacturer with an agreed percentage of the sealed-bid market.

The indictment sets these agreed percentages as follows: GE—39%, Westinghouse—35%, I-T-E—11%, Allis-Chalmers—8%, and Federal Pacific—7%. At these meetings, according to the indictment, the defendants "would then discuss future bid invitations and designate which manufacturer should submit the lowest bid therefore, the amount of such bid, and the amount of bids by others."

With respect to bids to public utilities and other purchasers, the indictment charged that defendants used a formula, designated as "Phase of the Moon," under which, "through cyclic rotating positioning inherent in the formula, one defendant firm would quote the low price, others would quote intermediate prices, another would quote the high price," and "these positions would be rotated . . ."

Defendants React Quickly

Defendant manufacturer reactions to the indictments were quick. GE Board Chairman Ralph Cordiner pointed out that although "this is a matter which involves only a handful of the 275,000 General Electric employees throughout the world, it in no way lessens the gravity we attach to the situation." Cordiner went on to restate the company's policy regarding compliance with the anti-trust laws, concluding, because of the seriousness of the indictments, that "It would obviously be inappropriate for the company to comment further while the cases are before the courts."

While GE may have had some idea that it was in for an indictment, as evidenced by Cordiner's recent action of disciplining subordinates involved in collusive practices, last week's action "came as a shock to management" at Westinghouse. The company cited several reasons: (1) The actions charged to its employees are "completely contrary to long-established policies which govern the conduct of the company's business"; (2) Beyond the policy of strict adherence to the law, the company's policy is "to conduct its business on ethical standards that are beyond challenge"; and (3) "The indictments involve product lines on which prices have been declining, not rising. Actions as charged in the indictments certainly did not react to the benefit of the company or against the interest of customers and the public."

INVESTIGATOR: W. L. Maher, who prepared cases for Anti-Trust Div of Justice Department

An Allis-Chalmers statement, issued prior to the indictments, deplored the violation of the anti-trust laws. It insisted employees involved "cooperate to the fullest with the investigation, and to tell the truth, the whole truth, regardless of its possible impact." A-C Pres R. S. Stevenson said "To the extent that any (employee) may be guilty, we have urged each to admit his fault and seek the mercy of the court."

Utilities Comment Also

Utility reaction was swift also. Said Commonwealth Edison's Director of Purchasing R. B. Gear: "I think it's a healthy thing, particularly on equipment of this type. The development won't affect our purchasing policy as I see it; where else are you going to buy it?" Asked if his company might buy foreign equipment, he said it might. He described the alleged price-fixing as "one of the rackets going on." "Distribution transformers are just as bad, if not worse," he said.

Alabama Power's George Cole said the grand jury's action "is not surprising." Cole believes in administered prices "if they are fairly administered."

Named as defendants in the first indictment were: General Electric Co and the following GE personnel: G. E. Burens, vp and general mgr, Switchgear and Control Div; L. J. Burger, general mgr, Switchgear and Control Div; C. E. Burke, general mgr, High Voltage Switchgear Dept;

(*Continued on page* 48)

A Look at Power Sales Problems

Industrial, commercial force needs recognition and management support, AEP's Shannahan says; marketing objectives should guide salesman's selection, advises CL&P's Fratus

In an age of rapid technological change the utility marketing and sales executive is grappling with a problem dating back almost to the idea of central station power. The problem: How to best organize, train and supervise his sales force while selling his top management on changes that can improve the relations, stability and profitability of industrial and commercial customers.

Although the problem remains the same, some techniques to solve it have acquired new terminology and an occasional new twist. But the most significant I&C gain appears to be the gradual widening of management awareness that the big customer merits, wants and needs specialized attention, attention commensurate with the revenue the customer's load represents.

These are the general impressions that resulted from an American Management Association seminar in New York late last month. About 35 utility men and two communications women attended.

One of the requisites of insuring that the I&C customer gets efficient utility assistance is a smoothly working power sales organizational set-up. This point was developed by John Shannahan, assistant vice president of sales, American Electric Power Co.

In the decentralized company, such as AEP, the division manager is in complete charge and "without his active backing your sales program is going to suffer." The same support must come from the chief executive, "who should make it clear he holds the division manager responsible" for sales performance.

Boosting Power Salesmen

Shannahan stressed that I&C departments must provide a channel for power salesmen's promotions. "Single out your men, give them a chance to express ideas, build up their prestige in the customer's eyes," he suggested. One AEP operating company president, he said, on each new industrial assignment, writes the customer a letter introducing the salesman while giving him a pat on the back.

Perhaps the utilities need a counterpart for the accounting profession's CPA and the insurance field's CLU, Shannahan said. He cited one study—not an AEP company—showing 38% of a utility company's employees were dissatisfied, mostly with prospects for opportunity and, to a lesser degree, with compensation.

Over-Supervising Tendency

The part that supervision plays in a good sales program generated discussion. There is a tendency to over-supervise, Shannahan opined, and this leads to red tape and less direct action.

An American Tel. & Tel. Co. man said extensive research showed that six men for one supervisor was the ideal number. Above seven men, said Stanley F. Damkroger, assistant vice president, the supervisor's revenue per man drops off. Chick Shotwell, Philadelphia Electric Co, said eight salesmen per supervisor is tops for his department.

J. V. Fratus, Connecticut Light & Power Co, said that, in order to guide sales personnel to greater efficiency, marketing objectives must be determined. It is essential to crystalize sales objectives and methods by which these objectives are to be reached.

Guide to Recruiting

The utility's marketing philosophy will provide the basis for defining the salesmen's job and how it is to be done, said Fratus, who is CL&P's training coordinator. This results in specifications of the factors required of an individual to perform the job, and this tool guides the recruiting effort.

Fratus emphasized that these activities are part of a total process integrated to achieve the broader purpose of sales manpower development.

Probably the most effective means of I&C advertising and promotion is direct mail. Emil Hofsoos, a Ketchum MacLeod & Grove, Inc, vice president, advanced this view, adding that the effort must be well-planned and coordinated. The method is flexible and inexpensive.

(*Continued on page* 99)

JOB UNREST—reflected in saying, "Once a power engineer, always a power engineer"—can be cut by providing promotion "channels," says Shannahan

A-Plan Unveiled By AEC for Decade

McCone outlines 10-yr program to Joint Committee. It's aim: Commercial A-power by '70

A ten-year civilian reactor development plan designed to achieve economically competitive atomic power by 1968 has been unwrapped by the Atomic Energy Commission.

AEC Chairman John A. McCone on Tuesday told Congressional Joint Committee on Atomic Energy the task can be accomplished in high-cost fuel areas through the orderly construction of experimental, intermediate prototype and large scale reactors, he said. By 1968, technological progress and experience will have been amassed within the pressurized and boiling water reactor types to justify a decision by utility executives to build full size nuclear power stations. Competitive nuclear power costs are defined as 7 mills per kwhr for a 300-Mw single unit fossil fuel station using fuel costing 35¢ per million Btu at 80% load factor.

The ten-year plan, first initiated in 1958 but just released in final printed form, scored a favorable psychological triumph before the joint committee.

Many Democrats have objected that the costly business of getting on with atomic power was being left to the "mercy" of private utilities.

In the three-phase pattern of the new plan, joint committee Democrats noted that construction of large scale plants again pivots on the willingness of private utilities to finance them.

I. Utility Participation

Utilities are urged in the plan to undertake primary responsibility for construction of large scale A-plants beginning in some cases with the present fiscal year. Manufacturers have advised AEC that 300-Mw PWR and BWR can be built now which may be competitive.

Principal conclusion of the plan, however, is that by 1968 technology of light water reactors would have progressed sufficiently to allow utilities to make bona fide economic decisions to build full size A-plants.

AEC would finance experimental reactors and jointly finance with industry intermediate sized prototypes. Alternatively, prototypes could be built and operated by AEC.

The plan, as outlined by McCone, stressed the importance of integrating large plants and, when possible, intermediate prototypes as well, into grids.

II. Financing and Costs

A system of capital grants proposed by AEC last year to be made available to industry-sponsored projects was left out of the plan. Due to the antagonism of some atomic leaders in Congress and industry, the subsidy idea has apparently been abandoned.

Total cost of the program: $200 million a year.

Most of this would go to cooperatively-sponsored projects in the form of initial research and development assistance; waivers of reactor fuel-use charges; design, construction and operation of AEC initiated experimental and prototype projects; and general engineering support of civilian power.

In addition to stressing present possibilities of water reactors, the AEC emphasized the importance of nuclear superheat and organic moderated reactors. A 100-Mw superheat prototype probably would be initiated in 1963 and a 300-Mw plant by 1968. Whether or not a 50-100-Mw organic type is justified for construction by 1965, the ten-year plan indicated they should be competitive by 1966 in 300-Mw sizes.

The plan lists 1960-70 spending on sodium cooled reactors at $520 million and on gas-cooled reactors at $228 million.

III. Outcome Hinges on Big Companies

Outcome of the whole plan now depends on whether utilities will come forth to build large A-plants.

And so far the four utilities presently capable of putting a big reactor into their transmission systems have indicated that the final decision to do so may be pretty far off. Pacific Gas & Electric, Southern California Edison, Niagara-Mohawk and New England Gas and Electric have all indicated one to seven years additional time is needed.

Federal Jury Indicts Five Firms (*Continued from page* 46)

H. F. Hentschel, general mgr, Medium Voltage Switchgear Dept; F. E. Stehlik, general mgr, Low Voltage Switchgear Dept; G. R. Fink, product sales mgr, Medium Voltage Switchgear Dept; and Houston Jones of Low Voltage Switchgear Dept. Also named were Westinghouse and the following Westinghouse employees: Landon Fuller, assistant general mgr, East Pittsburgh Div; J. T. Thompson, sales mgr, Assembled Switchgear and Devices Dept; and A. W. Payne of the same department. Allis-Chalmers Co was indicted, along with L. W. Long, D. W. Webb and F. M. Nolan, all of the Power Equipment Div; also I-T-E Circuit Breaker and Federal Pacific.

Under the second indictment: General Electric Co and C. E. Burke, R. C. Crawford and W. H. Schiek, all of the High Voltage Switchgear Dept; Westinghouse and J. W. Stirling of its Power Circuit Breaker Dept; Allis-Chalmers and L. W. Long; I-T-E Circuit Breaker Co; and Federal Pacific.

Under the third indictment: General Electric Co, with F. E. Stehlik and R. W. Ayres, Jr., both of the Low Voltage Switchgear Dept; Westinghouse, along with J. T. Thompson and W. T. Pyle; and I-T-E Circuit Breaker Co.

5-Mw Coal-Fired Gas Turbine To Be Linked With Steam Unit

Muskingum River turbine to operate in combined cycle with 215-Mw steam unit; first for producing electrical energy

S. N. FIALA, Vice President and Chief Engineer, American Electric Power Service Corp, New York, N. Y.

C. W. ELSTON, General Manager, Gas Turbine Department, General Electric Co, Schenectady, N. Y.

The decision to install a 5,000-kw prototype gas turbine, burning coal gas, at Muskingum River Plant, near Beverly, Ohio, was announced jointly Feb. 1 by the American Electric Power Co and General Electric Co.

The gas turbine will operate in a combined cycle with unit No. 1, an existing 215-Mw steam unit at the AEP plant. This combined-cycle installation will be the first employing a coal-gas-fired gas turbine for producing electric energy.

This article sketches the background of the joint announcement. It cites the potentialities that may be opened up by the success of the undertaking, and indicates the type of information which it is hoped, will be developed by the project. Distinctive details of the combined cycle installation are described.

Combining the gas turbine with the steam cycle has been studied as a way of improving the efficiency of thermal power generation within the limitations of the gas turbine. Besides being a prime mover, the gas turbine is a source of hot compressed air or exhaust gas that is usable in various ways. The exhaust gas, containing much of its original oxygen, can be used as pressurized combustion air for a steam boiler, thus replacing conventional forced-draft fans and air heaters.

Usable on Any Steam Cycle

The gas turbine also can be superimposed on any steam cycle, even the most efficient supercritical-pressure cycles, with a resultant improvement in efficiency. Several combined gas-steam turbine cycles, such as the supercharged boiler and exhaust-fired boiler cycles, offer impressive gains in thermal efficiencies over the base steam cycles with which they were combined.

These combined-cycle plants have one major drawback—fuel. The gas turbine becomes economically attractive and a major factor to most utilities only when it is fired with coal. So far, the problem of cleaning the gases from burning coal to the extent necessary to avoid serious gas turbine erosion has defied economical solution. All previous approaches and cycles, in which the gas turbine was directly fired by or had to handle all of the combustion products of coal, bogged down over this problem.

Heart of Cycle Is Carbonizer

A joint effort was initiated in July, 1959, by GE, Babcock & Wilcox, and AEP to investigate a promising new concept for burning coal in the gas turbine. The heart of the new cycle is a low-temperature, fluidized-bed carbonizer which breaks down coal into both a combustible gas suitable for burning in the gas turbine combustors and a solid char for firing in a conventional boiler. The Muskingum carbonizer, admittedly one of the major question marks in the cycle, is sufficiently large so that extrapolation to a full commercial-size unit should present only incidental difficulties in scaling up to size.

The gas produced by this carbonizer, composed principally of methane, light oils, tars, and nitrogen, can be cleaned of any solid particles carried over from the fuel bed by a relatively simple series of mechanical dust collectors. Coal ash, so troublesome in the past from the standpoint of gas turbine erosion, remains in the char and is removed by the boiler's ash-handling system.

A schematic arrangement of a cycle employing this carbonizer is shown in Fig 1. This cycle can be integrated readily with the most modern and efficient steam cycles. Ambient air is compressed by the gas turbine compressor to 6 atmospheres. About 7% of the air has its pressure raised to 8 atmospheres by

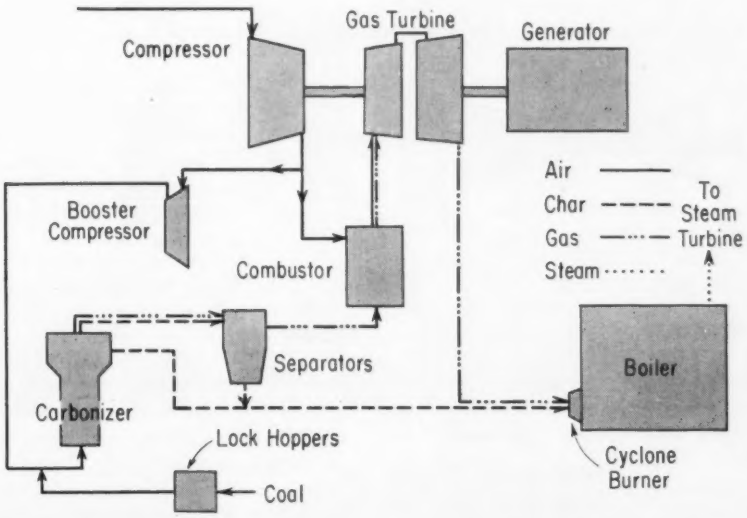


FIG 1—SCHEMATIC shows the general arrangement of a combined cycle-carbonizer plant. The cycle is readily integrated with most efficient steam cycles

a booster compressor to feed coal into the carbonizer, keep the bed in suspension, and oxidize the coal enough to maintain carbonizer temperature.

The carbonizer operates at about 7 atmospheres and 1,100F. Product gas passes through mechanical dust separators before entering the gas turbine combustor, where it is fired with the balance of the compressed air. After passing through the gas turbine, the exhaust air supplies all of the heated secondary air for burning carbonizer char in a conventional-type boiler to make high-pressure, high-temperature steam.

Crushed coal enters the carbonizer cycle through a lock hopper system in which the coal is pressurized to 8 atmospheres so that it can be fed to the carbonizer. Char then feeds from the carbonizer, through a char feeder, into a cyclone-furnace, where it is burned with the gas turbine exhaust. Carbonizer char, in pulverized form, can be burned also in the boiler, in which event a pulverizer capable of handling hot char will be required.

Operation of the prototype unit at Muskingum River Plant, scheduled to begin in early 1961, should provide information on such unanswered technical questions as:

1. What problems will be introduced by a major scaling up of carbonizer size from the Southern Research Institute pilot carbonizer? Will agglomeration be troublesome in the carbonizer? Does the carbonizer have enough flexibility to restart quickly after emergency trip?

2. Can the carbonizer's gas output be cleaned sufficiently to prevent excessive gas turbine erosion?

3. Can a cheap and efficient method of pressurizing coal to 8 atmospheres be found? What coal flow problems will be involved in feeding and storing coal at this pressure?

4. How are the controls of the carbonizer, gas turbine, and other carbonizer-cycle equipment best integrated with steam unit controls?

Problems Studied in Prototype

These and other problems inevitably encountered in any new development can be more readily and efficiently resolved in a prototype installation like Muskingum.

Combining the gas turbine-carbonizer cycle with the most modern, double-reheat, supercritical-pressure steam cycles in large unit sizes promises another major breakthrough in the economics and efficiency of generating electric power. By such means, it may become possible to expand the applications of the gas turbine into the large blocks of energy generation which are and will continue for a long time to be supplied by coal.

The potential gains can be visualized by comparing heat balance data for one of today's most efficient supercritical-pressure, double-reheat steam cycles with data for this same cycle modified by the addition of a gas turbine-carbonizer unit. For both cases the basic cycle, with steam conditions of 3,500 psi, 1,050/1,050/1,050F, is essentially that of the Breed Plant unit No. 1, modified to incorporate low-drop cyclone furnaces for the steam generators. A simplified heat balance of the conventional steam unit is shown in Fig 2, net capability being 455,300 kw at a heat rate of 8,690 Btu per kwhr.

This basic steam cycle, combined with the gas turbine-carbonizer unit, is shown in Fig 3. There, with the same steam turbine-generator set, net capability has been increased to 571,600 kw and the heat rate reduced to 8,360 Btu per kwhr, an improvement of 3.8% over the

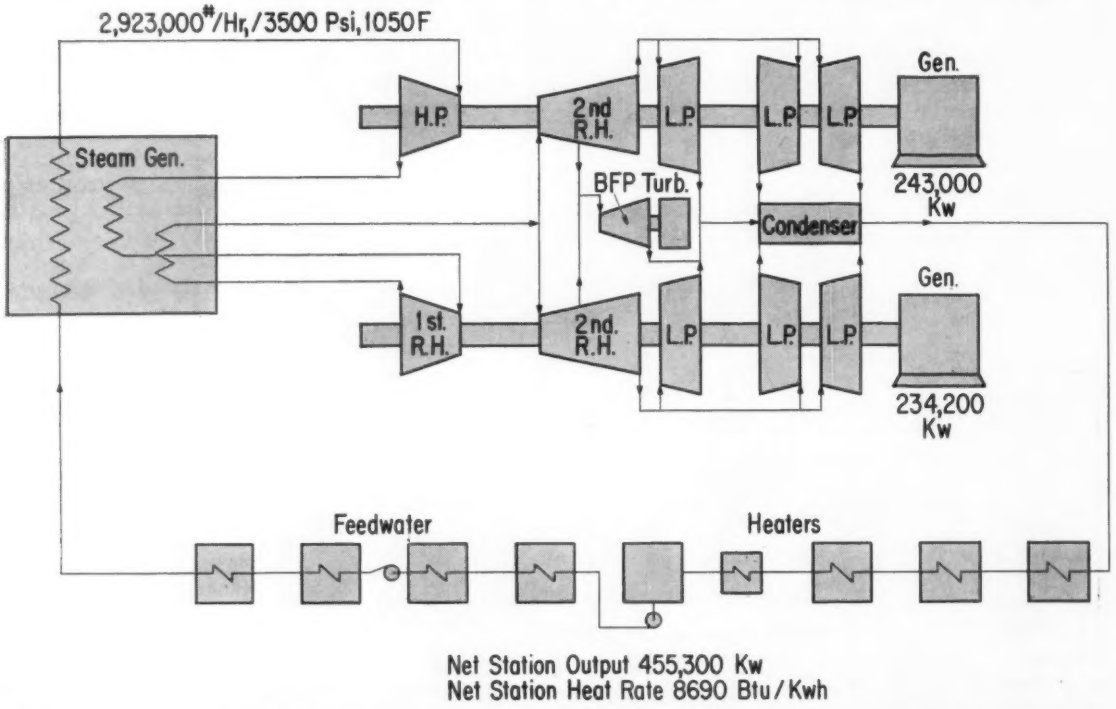


FIG 2—CONVENTIONAL STEAM UNIT simplified heat balance shows net capability to be 455,300 kw at a heat rate of 8,690 Btu per kwhr. It can be combined with gas turbine as shown in Fig 3 above at right

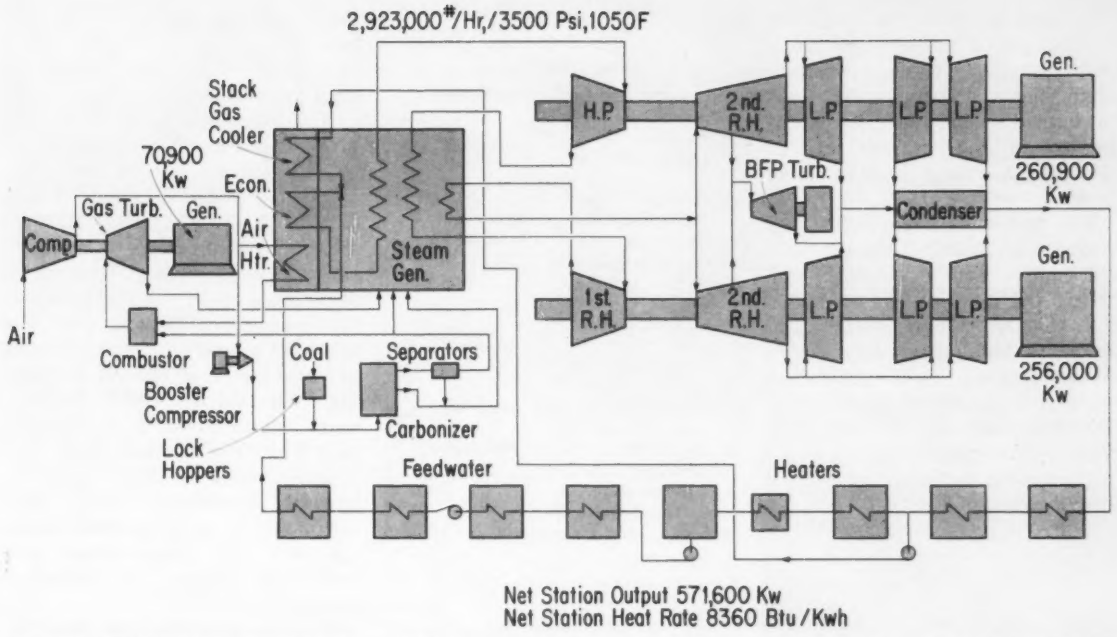


FIG 3—SCHEMATIC shows combined gas turbine-supercritical-pressure cycle, where, with the same steam turbine generator set, net capability has been increased to 571,600 kw and heat rate cut to 8,360 Btu per kwhr

basic conventional steam cycle.

The combined cycle will require about 70 Mw of gas turbine capacity which, it now appears, would be supplied most economically by two gas turbines of 35 Mw each. All air used by the steam generator will be provided by the gas turbines. Although the economics of this full-scale cycle have yet to be developed, the ultimate objective will be to build the combined-cycle plant at the same dollars-per-kw cost as a conventional supercritical-pressure unit.

The AEP-GE developmental program has as its ultimate objective full commercial development of the combined cycle-carbonizer plant. As the first step, a prototype coal-burning gas turbine-carbonizer unit will be built to operate in conjunction with Muskingum River unit 1. To minimize developmental costs, the prototype unit will employ the smallest commercial gas turbine made by GE and will be designed so as not to impair the availability or capacity of the existing steam unit.

Prototype components will be primarily conventional and relatively standard equipment, except the carbonizer and its associated coal-feed system. The GE gas turbine will be a Frame 3, simple-cycle, two-shaft unit nominally rated 5,650 kw, driving a 6,250-kva, air-cooled generator. More than 90 such units have been built.

The two-shaft unit, capable of running as either a variable or fixed-air flow machine, will provide flexibility in the investigation of the effects of high-excess air at part loads on boiler and cyclone operation. To permit simulation of single-shaft turbine, fixed-air-flow operation at part loads, provision will be made to bypass up to 60% of gas turbine exhaust flow direct to the boiler furnace.

Burn Char in Cyclone Furnace

Carbonizer char will be fired in a 9-ft-dia cyclone furnace tied into one furnace sidewall of the boiler, a wet-bottom type. B&W will furnish the cyclone furnace and will assist AEP in some design features of the system. The cyclone furnace will be a new low-pressure-drop type to help reduce back pressure on the gas turbine. The cycle is especially sensitive to pressure losses which ruled out the use of a conventional cyclone furnace.

Designed for an initial pressure drop of 30-in. of water, the cyclone will have a pressure drop of only 20 in. of water after further refinement. Total heat input for the cyclone furnace will represent about 16% of boiler full-load heat input. Existing pulverizers will supply the remaining heat input.

The unit will consume about 25 tons of coal per hour at maximum load. Coal, crushed to ⅛ in. minus, will be supplied to the lock hoppers from an existing bunker through a 40-ton-per-hr belt, crusher, and bucket-hoist system. The lock hopper system is essentially two hoppers which can be pressurized by air in appropriate sequence to 8 atmospheres to bring feed coal up to carbonizer pressure.

Coal then passes through a variable-speed feeder and is injected by air into the carbonizer. As a suitable coal pump, when developed, will be probably cheaper than lock hoppers, space will be provided for future installation of a coal pump.

Bechtel Corp has been retained by GE to assist in designing the fluidized-bed carbonizer. Coal agglomeration in the bed will be prevented by mixing char with the coal as it is fed into the carbonizer. Air for fluidization and generation of carbonization heat, extracted from the main gas turbine compressor, will be pumped into the carbonizer by a booster compressor.

Product gas from the carbonizer will be passed through centrifugal dust separators into the gas turbine combustion chambers, where it will be burned. Char will be fed by gravity to the cyclone furnace through a variable-speed char feeder.

The unit will be controlled and loaded automatically from the main unit control room in a manner similar to a pulverizer on a conventional unit. Signals from the boiler steam-pressure controller will regulate the air flow produced by the gas turbine by varying compressor speed. Coal-char ratio will be maintained by changing the speed of the coal feeder in proportion to the air-flow signal from the gas turbine. This ratio will be adjusted, as necessary, guided by data from an oxygen recorder.

Carbonizer temperature will be kept constant by changing air flow to the carbonizer in accordance with the amount and nature of the coal processed. The gas-turbine firing rate will be controlled by maintaining its exhaust temperature at 925F by regulating the amount of product gas supplied. Any excess gas will be bypassed to the cyclone furnace.

Main Unit Independent

Main-unit operation will be entirely independent of the gas turbine unit, so that the gas turbine can be brought into or taken out of service without interference with normal operation of the steam turbine-generator unit.

Substantial experimental coal carbonization work has been done, but almost all of this work sought the recovery of tar, light oils, and chemicals. Hence, all of the experience now available is limited to operation at atmospheric pressure. One immediate objective of the developmental program on which GE and AEP are now embarked is the procurement of basic design data on carbonizer yields and operation at 7 to 8-atmospheres pressure.

Carbonizer product gas and char characteristics and yields may vary significantly with pressure, temperature, and coal volatile content. To obtain much-needed information on these relationships, GE has sponsored the building of an 8-in.-dia pilot fluidized-bed carbonizer unit at the Southern Research Institute. This unit is capable of operating at up to 8 atmospheres and 1,200F. It was first operated in February 1960.

The fluidized-bed carbonizer will be intially fired with Muskingum River coal to determine yield data over a range of carbonizer temperatures at 7-atmospheres pressure. Prototype operation will also be simulated to develop start-up and shut-down procedures and to investigate conditions following collapse of the fluidized bed and methods of refluidizing it after an emergency shutdown.

Product-gas dust loading tests will be run to optimize arrangement of gas-cleaning equipment. Other tests will be run to define some design problems in the auxiliary equipment, such as the char feeder. A longer-range objective of the pilot unit is to determine yield and carbonizing characteristics of the various coals commonly used by electric utilities.

Vital Statistics of Combined-Cycle Installation

Steam Unit

Main turbine generator	215 Mw
(Cross-compound, reheat unit)	
Steam pressure	2,000 psi
Steam temperature	1050/1050F
Furnace type	slag-tap
Fuel	pulverized coal
No. pulverizers	8

Gas-Turbine Unit

Gas turbine generator	5,650 kw
(at 35F ambient)	
Carbonizer	fluidized-bed
Pressure	7 atm appr.
Temperature	1100F appr.
Cyclone furnace dia	9 ft
Fuel	carbonizer char

Quest for Efficiency Continues

The AEP-GE project is part of the continuing quest of the electrical power industry to discover more efficient and economical ways of generating electric power. This tradition has brought such significant strides forward in the technology of generating power as the reheat cycle, superposition, major increases in steam temperature and pressures, large single boiler-turbine units, and recently, supercritical-pressure units. After the initial exploitation of each concept came a period of gradual development during which the concept was brought to fruition. Then the curve of progress leveled off until a new concept was introduced.

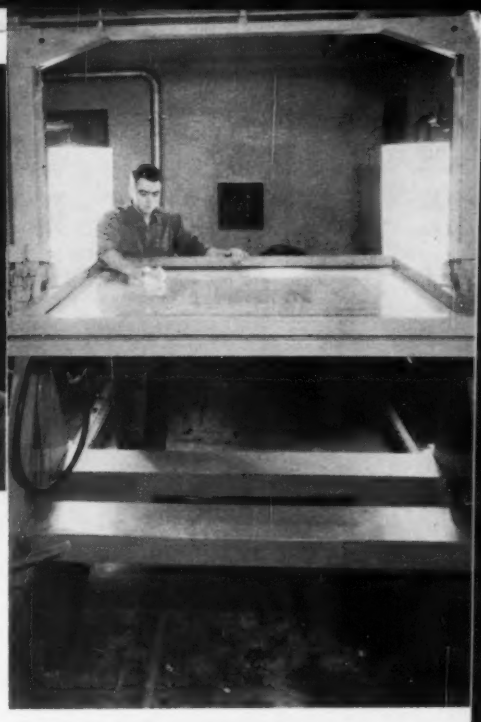
The mere 77-Btu-per-kwhr improvement in the heat rates of most efficient steam plant, in the U. S. from 1953 to 1958, compared with the 1,418-Btu-per-kwhr improvement in the preceding five years, dramatized a temporary leveling off in progress. But a substantial breakthrough will mark 1960, when the first large supercritical-pressure units —Breed No. 1 of Indiana & Michigan Electric Co (AEP System), and Eddystone No. 1 of Philadelphia Electric Co—now under construction, will be placed in commercial operation. These units operate at or near optimum steam pressures and temperatures now within the industry's technological grasp.

Further improvements from increased steam temperatures appear limited, as they are necessarily dependent on future metallurgical advances and economic acceptability of the super-alloys required. Unless some significant metallurgical breakthrough is made, the next major advances to follow the gains achieved by supercritical-pressure units will have to stem from approaches other than higher temperatures.

For many years, the gas turbine has excited much interest as a potential factor in the power supply of the U. S. A vast number of studies have been made to determine how the gas turbine can be used effectively in utility power generation, and some applications have been made, especially for peaking and standby service. But the gas turbine to date has not made a significant impact on utility power generation, primarily because of the need to restrict fuel to gas, distillate oils, or modified residual oils. Other factors militating against more widespread use of the gas turbine have been unit-size limitations and low thermal efficiency compared to modern steam cycles.

There is no question that experience to be gained in operation of the Muskingum River prototype unit represents a well-founded basis for realistic projection and assessment of the technical and economic feasibility of commercially sized combined cycle-carbonizer plants.

PLANNING ENGINEERS found easier and less time-consuming methods of laying out distribution circuits from the photocopy used in simplified work procedures



COPY CAMERA reproduces the engineering drawings, thus reducing a great deal of repetitive drafting work

Detroit Edison Simplifies Work To Save Engineering Time

Training was first step in a program that saves $100,000 annually and stimulates participation through recognition

G. A. ANTONETTE, Staff Assistant, Engineering Design Dept, Detroit Edison Co, Detroit, Michigan

Work simplification in Detroit Edison's Engineering Dept has resulted in saving thousands of hours of engineering time. This concerted drive to improve methods, save time and cut the costs of doing engineering and technical work has brought annual savings averaging $100,000 in manhours and materials.

For example, cable records operation which required four to five employees now are handled by two, with the other employees transferred to other work. In drafting, an expansion of the practice of photographic reproduction of similar portions of a drawing resulted in a 40% increase in its use. Divisions which did not use the practice now find savings through it.

Work simplification as applied to engineering must be tailored to engineering activities. Here is how the program was applied in Detroit Edison's Engineering Dept. Improvement suggestions solicited from all supervisors were documented and reviewed for possible application. Centralized staff assistance was provided to broaden the application of new ideas to circumvent their restriction to department segments.

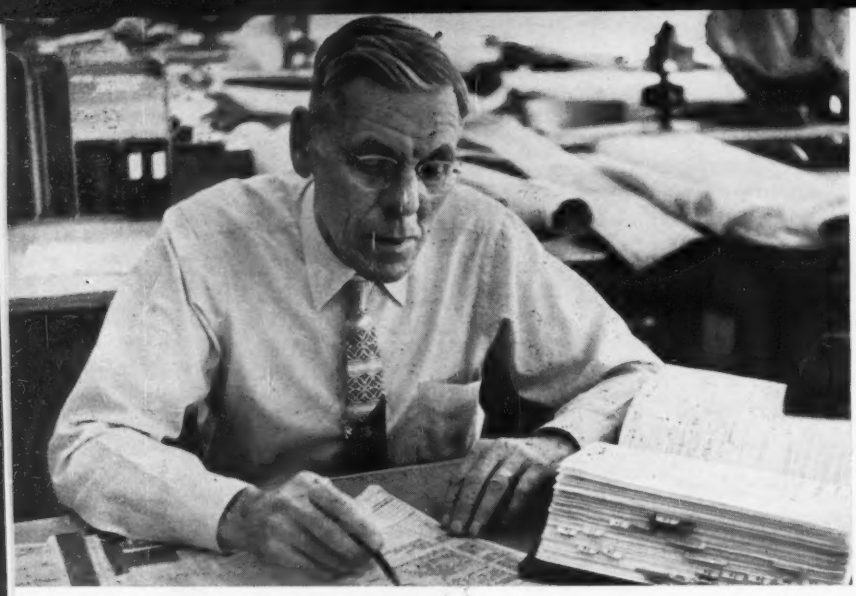
Training for the program was given through work simplification conferences, offered by management consultants, which provided the basic technique and varied approaches. Material and films were made available which formed a substantial background for work simplification. As a step toward tailoring the program, several groups in the department developed pilot plans which were used as examples. These were filmed for conferences.

Top management was in favor of work simplification. The initial phase of the program began with conferences of department and division heads, with the vice president and the manager of engineering taking part. Reasons for adopting work simplification were outlined at these meetings, which took 8 hr.

To familiarize all Engineering Dept employees with work simplification principles, a 20-hr presentation was prepared for line supervisors and professional non-supervisory employees; an 8-hr presentation was planned for other non-supervisory employees. Short introductory sessions were held for all department employees to create interest and eliminate possible misunderstanding. In two 2-hr sessions, 450 employees were given a resume.

Conferences for first-line supervisors were scheduled immediately following the introductory session. Material was selected that related to procedures in engineering departments. Films showing factory or production processes with time study were used only where the implied message was appropriate. Application of work simplification to improve existing engineering work patterns was emphasized. Process charts demonstrated how necessary and effective work is separated from unnecessary and unproductive work. Development of a healthy attitude was a basic aim.

Conference groups were kept to



LOAD CHARTS were given the new look and their preparation time was reduced 75%. This was another important factor in the successful work simplification

12 to 16 members, with presentations conducted over an extended series of 2-hr weekly meetings. This permitted the application of principles of work simplification as they were acquired. The extended conference series also permitted orientation of thought and voluntary adaption to pattern to help overcome factors of habit, complacency and resistance to change. Participation in the conferences was active. Many work situations of long standing were analyzed, particularly where duplication appeared to exist.

To obtain the full benefit of such a program, the techniques of work simplification must be made a part of the everyday work pattern. To accomplish this, a plan of supervisory committee action was adopted. Because the first-line supervisor is most familiar with detailed work practices and their relation to other areas, this proved practical.

A typical committee has each division represented and all supervisors serve through membership rotation. The chairman is selected by the committee for a term to overlap membership rotation for continuity. The department head participates frequently in committee meetings.

Problems reach the committee through objectives suggested by the department head, through employee suggestions, from other departments and from the first-line supervisor. In one case, a project group was set up to study a monthly 40-page report, 70 copies of which were being distributed. It was found that half of those receiving the report would be satisfied with one copy annually. Also, data in the reports were being converted to curves by engineers and technicians.

The report now is prepared quarterly as a set of curves, with only nine copies being distributed. The curves are plotted by the girls who originally tabulated the data. Work simplification also led to development of rubber stamps for instrument drawings and panel layouts. This use saves much time and has helped to meet schedule dates.

Another change through work simplification was the reduction of the cost of railings in power plants. Railings formerly of cut and weld construction now are welded to the post. In another case, analysis of the distribution of copies of design drawings for substations eliminated four drawings per substation. These examples illustrate typical project group action and demonstrate the ability of the work simplification approach to facts and solutions.

Problems influenced by activities outside the Engineering Dept are handled by a committee. Most problems referred to the committee are delegated to project groups. Meetings are held monthly but subcommittee or project groups meet as often as necessary to complete a project. Recommended solutions are submitted to the department head for approval and implementation.

Success of the committee approach in engineering has prompted other departments to adopt this pattern in their work simplification activities, and with good results. Assistance in correlating committee functions with work simplification is provided by staff members, who also act as a liason and consultant group for methods implementation.

A major factor in the success of work simplification is the recognition accorded for participation. A departmental bulletin describes improvements made and gives recognition to the individuals or groups responsible for them. Statements from management support the work and give credit for the progress. An employee proposal plan offers further incentive and recognition. After work simplification was effectively under way, employee proposals in the Engineering Dept tripled in one year and the acceptance rate of proposals increased.

Reports to top management on progress through work simplification initially were semi-annual, but annual reports proved more practical. Evaluating progress is usually a matter of comparing the old and the new method. In certain phases of engineering however, work measurement is not easy. To encourage the reporting of improvements, a simplified desk pad form was adopted. Improvements are reported at each committee meeting; from these records an annual report is prepared. Simplification eliminated much resistance to reporting results.

TRANSPARENCIES provided a quick, easy means to plant pipe layouts

Furnace Supply Minimizes Flicker

Synchronous condensers at utility sub supply reactive component. Use of FOA transformers saves $11,000

R. L. SKONE, Dept of Lighting, Seattle, Wash.

The power supply designed by Seattle City Light to serve two 25-Mva 100-ton electric furnaces is limiting fluctuations to other customers to approximately 0.5 volts on a 120-v base. Based on 18 months of experience, the resulting flicker is below the borderline of irritation for the most severe type of load fluctuations.

The two furnaces, at Bethlehem Pacific Coast Steel Corp, are served by two 795-MCM, 34.5-kv feeders, emanating from a 34.5-kv ring bus at SCL's South Substation, two miles away. A 30-Mva synchronous condenser, located at South Substation, provides full reactive component needed, exclusive of cave-ins. To maximize reliability, 34.5-kv ring buses were used both at South Substation and the Bethlehem plant. The furnaces are supplied by two 230/34.5-kv 25-Mva FOA transformers, operated in parallel on all three windings.

The source of supply was selected by computing system impedance X_{MN}, for various buses on the system, with the furnace rating as a base. Values are shown below:

Bus		X_{MN}
South Sub	26 kv	0.025 P. U.
Duwamish	26 kv	0.025 P. U.
South Sub	55 kv	0.0178 P. U.
South Sub	115 kv	0.0448 P. U.
Duwamish	230 kv	0.0087 P. U.
South Sub	230 kv	0.0075 P. U.

Three of these buses have an impedance which is better than the "border-line" curve of recommended practice. These are the South Substation 55-kv, the South Substation 230-kv, and the Duwamish 230-kv.

The South Substation 55-kv bus was immediately discarded as a possible source because of double transformation and because it will be eliminated in the near future. The South Substation 230-kv bus was finally selected because of its proximity to the load, the existing condenser installation at South Substation which could be used for furnace reactive supply, and a saving of about half a million dollars compared with a supply from Duwamish. The only disadvantage with the South Substation installation is the considerable congestion both above and below ground.

One of the requirements for this power supply was very high service continuity. This immediately established the need for two lines—either one of which would carry the load—from South Substation to the Bethlehem Plant.

The continuity requirement also established the need for two transformers. The Bethlehem Corp agreed to reduced capacity operation in the remote event that we lost a transformer. This fixed transformer capacity at two 25-Mva units.

Starting Cold, SCL Checked Other Utilities' Methods, Studied All Means of Control

At the time negotiations to serve this furnace load began, Seattle City Light had had no experience serving furnaces even approaching this size. To familiarize themselves with the problem, SCL engineers collected all available published data and visited two other utilities serving 25-Mva loads.

The most complete technical literature available, an AIEE committee report (Paper 57-9), did not cover electrode voltages above 350 v. Since the electrode voltage at Bethlehem reaches 450 v, this material could be used only as a guide.

At the first utility visited, engineers were not concerned about the magnitude of flicker voltage as long as there were no complaints. For their 25-Mva furnace supply X_{MN}, the system impedance—which is common to both lighting load and furnace load, as shown in Fig 3—was 0.0118.

The second company sets a limit of 0.004 per unit volts flicker voltage for variations of one per sec or less, and designs its system to stay within these limits. Although the system impedance, X_{MN}, on the 120-kv bus serving their furnaces was only 0.0125, they installed two 50-Mva condensers and buffer reactors to reduce flicker to their established limit.

From these experiences, SCL concluded that no positive statement relating flicker level and tolerability could be made. It was decided to keep flicker voltages as low as possible and at least below the borderline of irritation.

Large load swings produced during charging and meltdown are not the most troublesome, as their frequency is relatively low. A greater problem is the extremely frequent flicker caused by smaller variations with a frequency not more than one per sec. The most objectionable flicker is cyclic flicker, caused by even smaller variations which have a frequency of four to six times per second.

The most obvious method of controlling flicker—making the system impedance, X_{MN}, so small that the voltage drop due to furnace load swings does not cause visible flicker—is seldom economically practical.

If a synchronous condenser were added at the point of supply to the furnace, reactive changes in furnace load would be shared by the system and the condenser in inverse proportion to their impedances. However, the impedance of a 30-Mva condenser is about 25 times system impedance for most large power systems, so the condenser contributes little.

By adding a properly sized reactor between the system impedance and the condenser, the condenser can be forced to contribute a larger share of the furnace reactive swings. This contribution can be further increased by placing a series capacitor in the condenser leads. This has the same effect as reducing condenser impedance.

Using capacitors instead of a condenser would only aggravate the flicker problem. A reduction in capacitor voltage due to furnace swing would cause a further voltage drop due to decreased output of the capacitors.

If capacitors are used, the increase in reactive load requirements of the furnace during a swing must all be supplied by the system. The increased voltage drop reduces the capacitor terminal voltage and therefore the capacitor output. The reduction in capacitor output must be made up by additional reactive supplied by the system. This in turn causes an additional voltage drop.

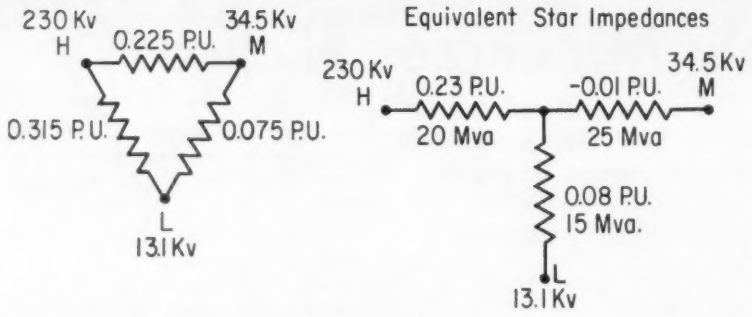


FIG 1. IMPEDANCE OF FURNACE TRANSFORMER was selected to make equivalent star 230-kv winding impedance as high as possible

Both OA and FOA transformers were considered. A 230-kv, 25-Mva, FOA transformer costs approximately $25,000 less than a 230-kv, 25-Mva, OA transformer. Its losses, however, are approximately 40 kw greater than those of an OA transformer. Evaluated at $350 per kw, the increased losses are worth $14,000. Because the cost of increased losses is less than the savings in initial investment, we selected FOA transformers.

We considered both 26 kv and 34.5 kv for the furnace supply. The City Light subtransmission voltage is 26 kv. Furnace switching air blast breakers rated at 34.5 kv were available, and the customer was willing to use 34.5 kv for the furnace transformer primary voltage, although 13.8 kv was preferred.

Computations showed a savings in line losses of 220 kw, or $77,000 at $350/kw for 34.5-kv over 26-kv transmission. Although 34.5-kv transmission meant that these transformers could never be used on our distribution system without modification, the possibility of losing the furnace load was so remote that it was not a deciding factor. Any subtransmission voltage higher than 34.5 kv would be economically unsound because of the additional transformation required to furnish a utilization voltage of 34.5 kv.

With two furnaces in operation, the maximum reactive requirement is about 30 Mvar, exclusive of momentary demands caused by caveins. There are several advantages resulting from locating the reactive supply at the load: reduction in transformer kva due to operation at unity power factor; reduction in transformer and line losses due to reduced current; and increased effectiveness of the condenser in controlling flicker. The increased flicker control results from higher transformer impedance (due to smaller size) and also the fact that

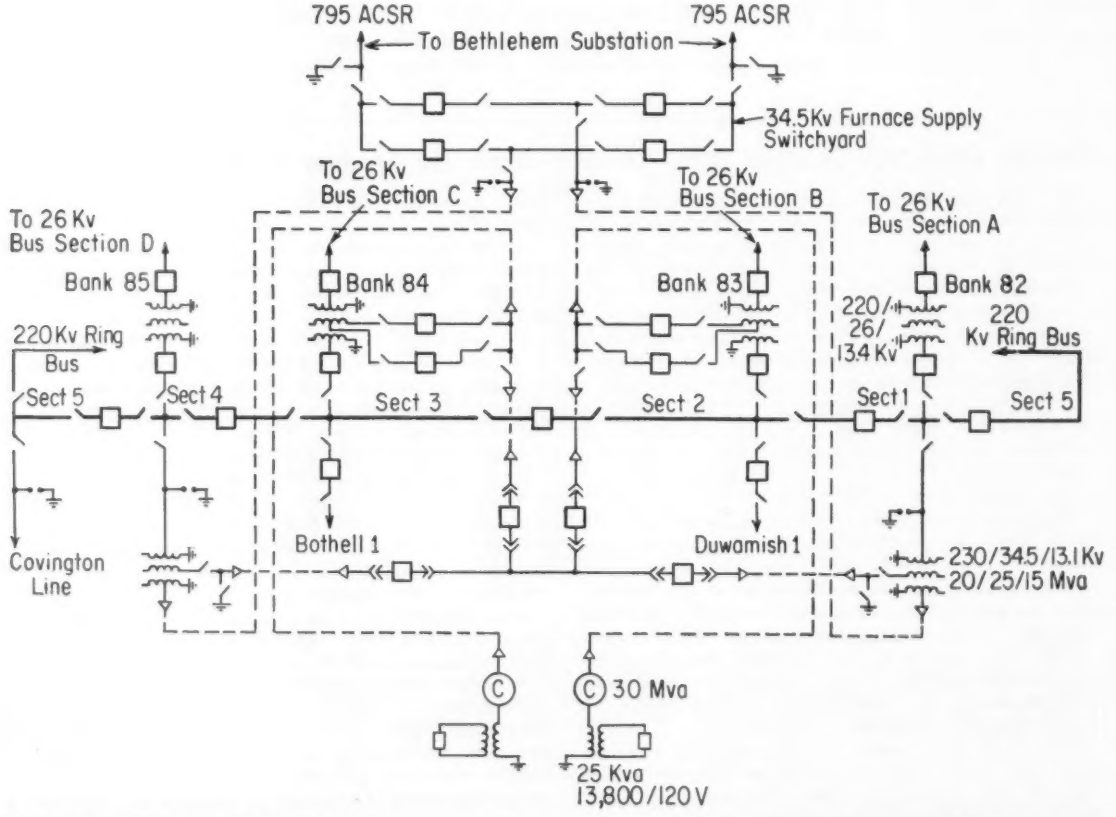


FIG 2. FURNACE SUPPLY TRANSFORMERS are operated in parallel on all three windings. Condensers at South Substation are started on starting taps of 230/26-kv banks, then switched to furnace supply transformers for running

the lines become part of the buffer reactance.

The disadvantage of locating the reactive supply at the load is the added cost of a 30-Mva, 34.5/13.2-kv transformer for the condenser. Since this added cost exceeded the benefits by approximately $50,000, the reactive supply was located at South Substation.

Before power capacitors were developed as an inexpensive, reliable source of reactive generation, City Light had installed two 30-Mva synchronous condensers at South Substation. In recent years our additional reactive requirements have been met by capacitors.

	Installed Cost per kvar	Losses per kvar at $350/kw	Total Cost
Synchronous Condenser	20.00	6.50	26.50
Switched Capacitor 26 kv	7.00	0.90	7.90
Saving	13.00	5.60	18.60

Based on these savings and the fact that lagging reactive capacity of both condensers was no longer needed for transmission system regulation during light system load, it was obvious that we should use the existing condensers for reactive supply to the furnace load. Two banks of capacitors, totalling 28,800 kvar, were selected to replace the one condenser used on the furnace supply.

In selecting the impedance of the 230/34.5-kv transformers for the furnace load, it was desirable to make the equivalent star 230-kv winding impedance as high as possible, since this impedance is equivalent to a "buffer reactor." To make the condenser most effective, it was also desirable to minimize the sum of the equivalent star 13.2-kv winding and 34.5-kv winding impedance. Fig 1 shows the impedances and ratings of the transformer windings, and the equivalent star impedances, both on the transformer Mva base.

Fig 2 is a one-line diagram of the South Substation installation, with the 26-kv, 55-kv and 115-kv buses omitted for simplicity. Note that furnace supply transformers are operated in parallel on all three windings. The condensers are started on the starting taps of the 230/26-kv banks and then switched to the furnace supply transformer tertiaries for running. Normally, only one condenser will be operated on the tertiary of the 230/26-kv transformer bank.

Due to the congestion, it was necessary to use a cable connection from the furnace supply transformer to the 34.5-kv bus. A ring bus was selected because of the high reliability required. This arrangement permits breaker maintenance without interrupting service.

The 34.5-kv breakers were taken from two of the 26-kv buses where the interrupting duty was approaching the breaker rating. These breakers were completely reconditioned before being placed in service in the 34.5-kv bus. New 34.5-kv breakers with higher interrupting rating were purchased as replacements for the breakers removed from the 26-kv buses.

The two lines from South Substation were constructed of 795-MCM ACSR cable. Either line can carry the load of both furnaces. A 34.5-kv ring bus is also provided at the Bethlehem plant. Back-up protection for the furnace switching breakers is provided by the oil breakers in this substation.

Fig 3 is an impedance diagram of the furnace power supply. Any changes in furnace reactive loading will be shared in inverse proportion to the impedances of the condenser and the system. The system will supply $\frac{1.665}{1.665 + 0.495}$ or 0.77 per unit of change. Investigations made by other companies indicated that the most severe furnace load fluctuation causing flicker was at the rate of 4 to 6 times per second, single-phase, and 9,120 kvar in magnitude. Using this value, the system will supply 0.77(9,120) or 7,020 kvar. This change in load causes a drop through the impedance X_{MN} of (0.03 + 0.03)(0.0702) or 0.00422 per unit. On a 120-volt base, 0.00422 per unit is 0.505 volts. A change of 0.54 volts is considered allowable.

Difficulty was expected with the condenser voltage regulators due to the very rapid load variation during the melt-down period. This proved to be the case. The regulator contactors operated so rapidly that they sounded like bursts of machine-gun fire. The condensers were then placed on manual voltage control and an order placed for rotating amplifier voltage regulators.

The new regulators have proved most satisfactory. They will pay for themselves through decreased maintenance and, moreover, have improved the customer's voltage regulation enough to increase the furnace output by 5%.

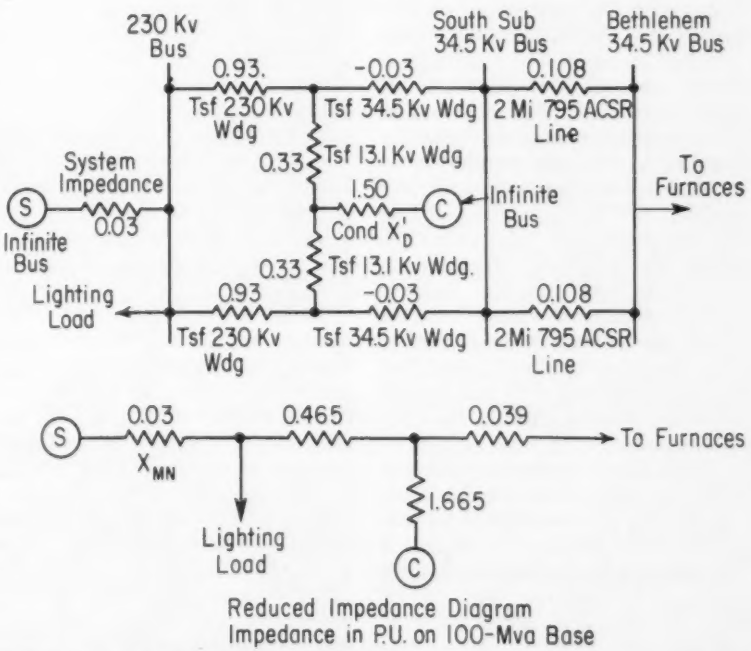
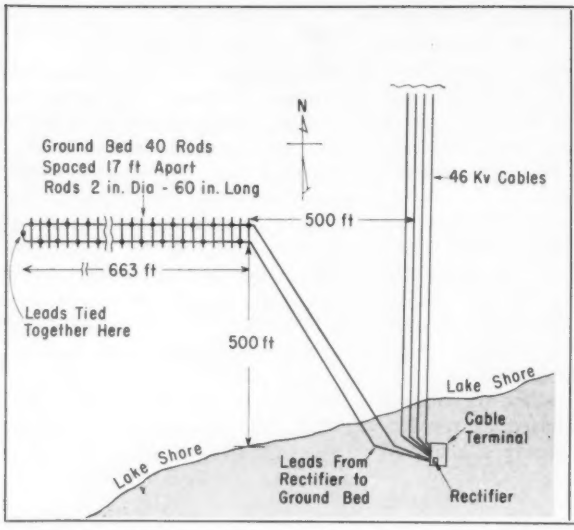
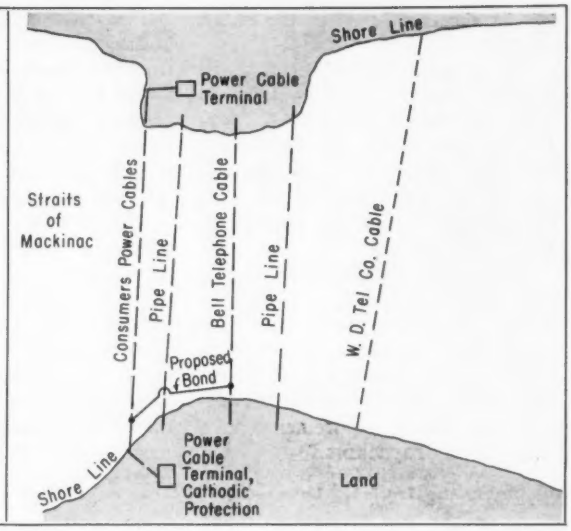


FIG 3. FURNACE POWER SUPPLY IMPEDANCES are shown in per units on a 100-Mva base. Reduced form is shown at bottom. System supplies 0.77 p.u. of change



DURIRON ANODE RODS form ladder with leads connected to alternate rods, with parallel leads set 4 ft apart



CATHODIC PROTECTION for Mackinac Straits underwater crossings was coordinated following joint studies

Coordinate Cathodic Protection

3 companies install rectifiers and ground beds when Consumers Power 46-kv submarine cables raise problem

GEORGE A. WHITFIELD, Underground Lines Engineer, Consumers Power Co, Jackson, Mich.

How to coordinate three-company cathodic protection became a problem after Consumers Power Co had installed 46-kv submarine cable across the Straits of Mackinac. Tests showed the problem would be solved by each company installing its own rectifier and ground bed.

Consumers Power's 46-kv cables parallel two pipeline crossings and the Michigan Bell Telephone Co's cable. The pipelines, owned by the Lakehead Pipe Line Co, had cathodic protection against damage from electrolytic action. Similar protection for the power cables had to be coordinated with that for the pipelines without affecting the telephone cables adversely.

The three companies became aware of the problem when soil potential tests, subsequent to the power cable installation, showed a current pickup at the cables' north end at Point LaBarbe and a current exit at McGulpin Point on the Strait's south shore.

Using a portable dc generator and an interrupter switch, testers switched current on and off at regular intervals and took potential readings at points 10 ft apart over the route of the buried cables on each shore. Two copper sulfate half cells served as soil contact electrodes. A graph was plotted, showing the anodic and cathodic areas along the cables to each shore line.

Enough information was obtained to determine the potential that should be applied to the cable armor to secure protection from the ground-bed current generated by the rectifier of the Lakehead Pipe Line Co.

These readings, along with subsequent soil-potential surveys conducted jointly, helped the three companies decide that each would make its own rectifier-and-ground-bed installation. The tests indicated that 20 amp dc would give the desired protection to the submarine power cables, and that the rectifier and the ground bed should be on the south shore. In that position, the latter would counteract more effectively the influence of the Lakehead rectifier on the north shore.

Consumers Power installed its rectifier inside the riser structure on the south shore, two leads connecting to the ground bed which is out in the Straits.

The rocky south shore near the power cables' termination and the problem of maintaining low ground resistance prompted Consumers Power to install its ground bed on the Straits' bottom about 500 ft offshore, the nearest end of the ground bed being 500 ft from the 46-kv submarine cables. This position reduced the likelihood of interference between the rectifier for the power cables and that for the pipelines and the telephone cable. The latter was between two pipelines.

The 663-ft ground bed consists of 40 Duriron anode rods 2 in. dia and 60 in. long. The rods are 17 ft apart, connected alternately to the two No. 3 RINC cable leads from the rectifier. At the ground bed, these leads are 4 ft apart. Thus the ground bed, laid on the Straits' bottom with the long axis at 90 deg to the 46-kv cables, has a ladder-like arrangement, with its west end about 1,100 ft west of the 46-kv cables.

The west ends of the No. 3 RINC leads from the rectifier were joined at the far end of the ground bed to form a continuous loop. Resistance of this loop is about 0.5 ohm; that of the ground bed from either or

(Continued on page 62)

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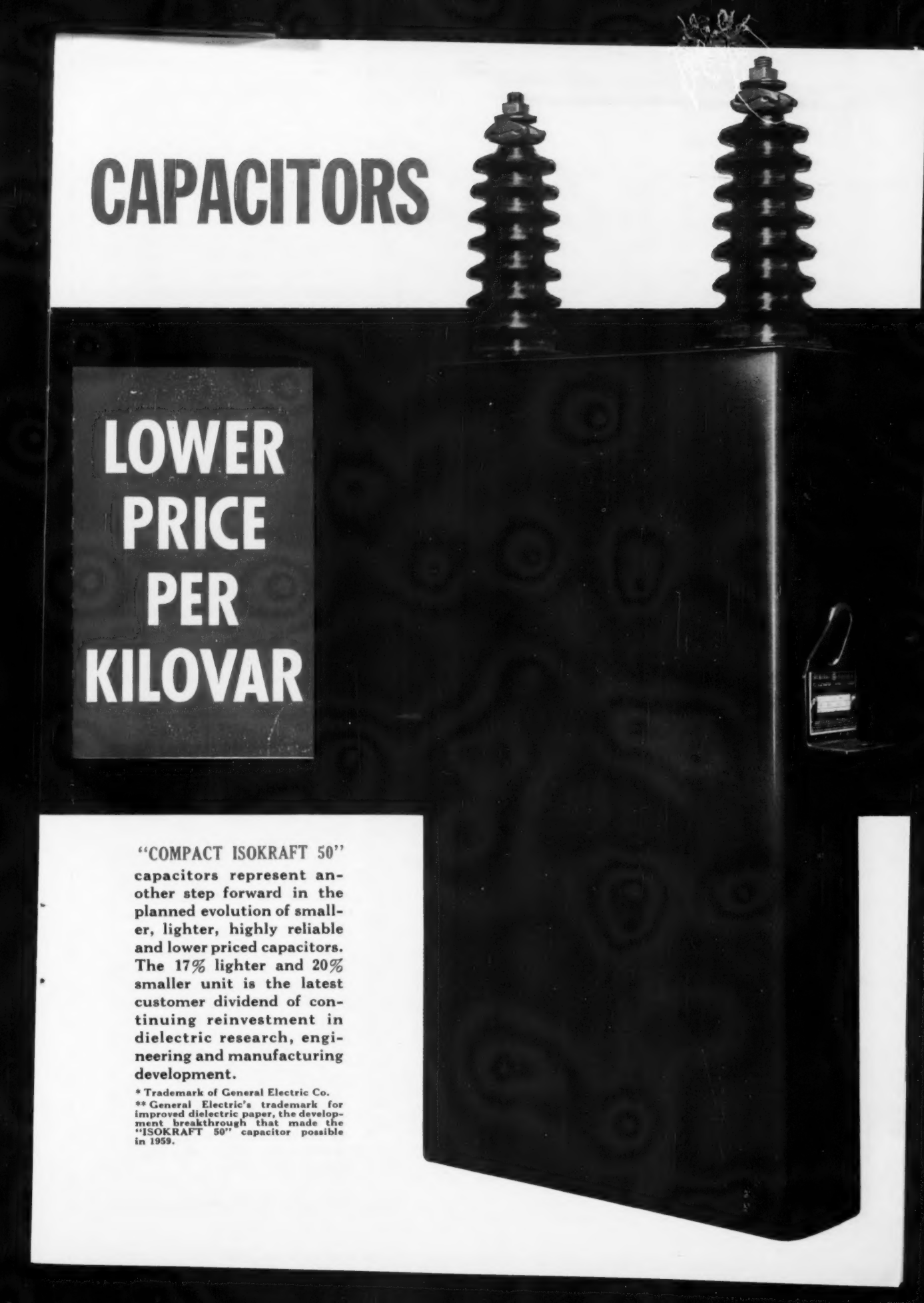

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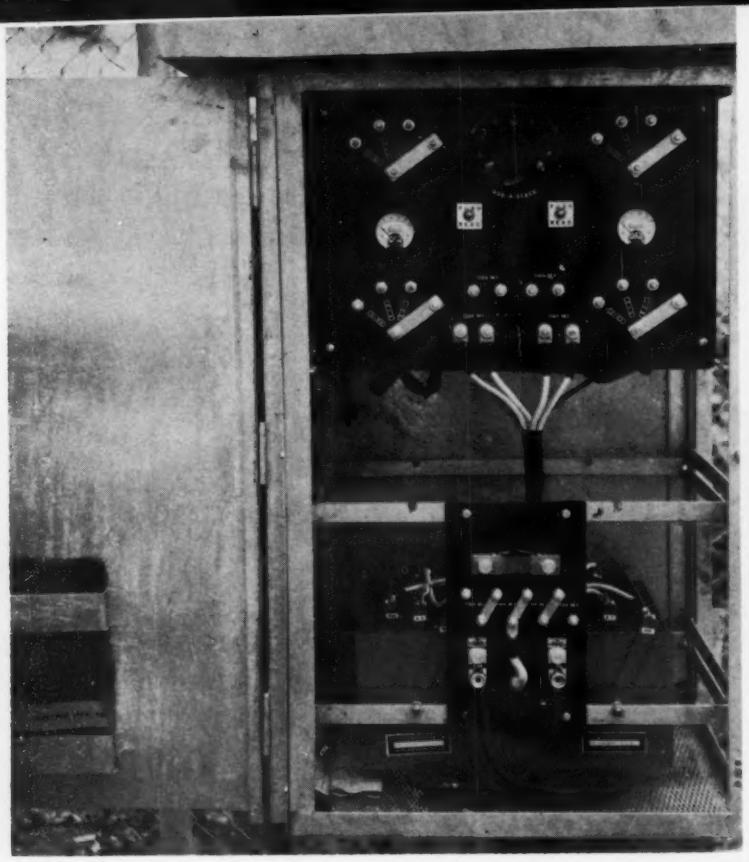


RECTIFIER CONTROLS permit adjustments to obtain desired voltage and current flow for best protection. Rectifier itself is in south shore riser structure

GROUND BED consists of 40 Duriron anode rods 2 in. dia and 60 in. long. Leads are connected to alternate rods and parallel leads are 4 ft apart

(Continued from page 58)

both conductors to water about 2 ohm. Checking the loop resistance detects a break in either lead to the ground bed. After leaving the ground bed, the two leads are about 2 ft apart, so that the entire ground bed continues to function with one lead severed.

Measurements made after the Consumers Power rectifier had been installed showed interference on the telephone cables. A bond between the telephone and power cables at the south shore has been proposed to eliminate it.

Both leads to Consumers Power's ground bed were broken and extensively damaged by ice and rock action after a year of service. They were replaced by armored conductors which, it is hoped, will eliminate such interruptions in the future. The two ground-bed leads were connected to the positive terminal of the rectifier, and a ground wire from the cable armor and lead sheath to the negative terminal of the rectifier.

Cathodic protection is adequate when, upon interruption of the rectifier, the armor and sheath negative potential changes 0.3 v with respect to remote earth. This change assures a current flow toward the cable that arrests corrosion. To obtain a —0.3-v change on the Straits' north side, 18 amp at 35 v dc had to be supplied from the rectifier, measured resistance of the ground-bed circuit being 2 ohm. Cable armor and sheath potential on the south side is —1.65 v for the same dc flow.

As the negative voltage change was 0.3 v or more on both sides of the Straits when the current was interrupted, it was concluded that there was a similar change all along the cables between the north and south shores. To produce 0.3-v change on the north side and —1.65-v change on the south side, the cable to remote earth potential was —1.3 to —1.4 v on the north side and —2.7 v on the south side, when the rectifier was operating.

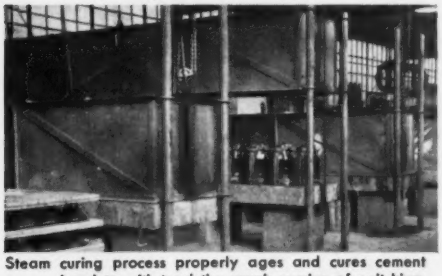
The rectifier should need very little maintenance. Without maintenance, the estimated life expectancy of the Duriron anode ground bed is 25 to 30 years, providing it is not damaged by ice or otherwise disturbed.

What you don't see may be more important than what you do see!
In CHANCE APPARATUS INSULATORS you don't see:
1 High-density wet-process porcelain for insulation and mechanical strength.
2 Sand-blast grips and pre-tested, steam cured cement to permanently bond parts together.
3 Special cushioning compound to compensate for different thermal coefficients of component parts.
4 Knurled gripping surface at top of pin.
But you do see:
5 Galvanized forged steel pin—heat-treated—accurately machined.
6 Sufficient clearance between edge of cap and shell to allow for thermal expansion.
7 Holes in base and cap are uniformly machined and insulator is jig-assembled for accurate stacking.

Specify CHANCE APPARATUS INSULATORS

for station insulators you can install and forget

Gilmore Needle Test is given all incoming cement to guarantee maximum cement strength.

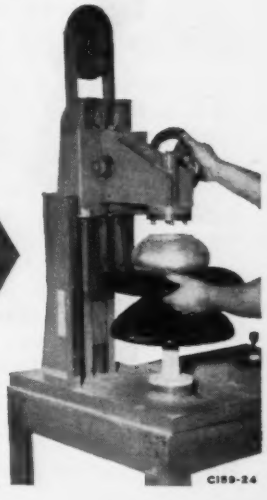


Steam curing process properly ages and cures cement bond to withstand the rough service of switching.

You can't see many of the hidden values that make Chance Apparatus Insulators perform so well—last so long. You can't see the quality of the cement—how well it is cured and properly aged. You can't see the inner construction features or the density of the porcelain...

But these hidden values are just as important to insulator durability as the many fine features that you do see when you examine a Chance Apparatus Insulator.

You can specify the insulators you want for your switch-gear—have the same uniform top quality insulators in your stations and on your lines. Just ask for Chance porcelain on all switch and bus specifications—no extra cost or trouble—and be assured of the best in substation insulators.



Every process, every part, every insulator is repeatedly checked through the entire production cycle. Here is an alignment check to assure absolutely accurate stacking for switch assembly. Every Chance Insulator is a "carbon copy" of the proven master design.

CIBS-24

You KNOW it's right when you specify CHANCE

A. B. CHANCE COMPANY CENTRALIA, MISSOURI

A. B. Chance Co. of Canada, Ltd., Toronto

YOU GET

LONG-LASTING PROTECTION FOR YOUR OVERHEAD SYSTEM

with

BLACKBURN *Grounding* DEVICES

Type GTC 1
One plate tower ground clamp

Type GTC 2
Two plate tower ground clamp

Copper Bonded Pigtail

Type GUV
U-bolt ground clamp parallel or 90°

Steel Driving Stud for Sectional Ground Rods

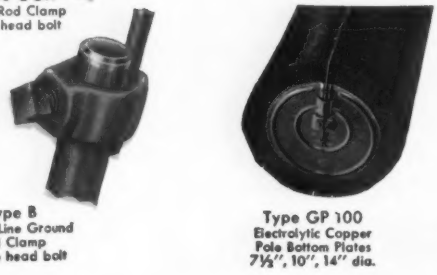
Type GG
Ground Rod Clamp
Socket set screw

Copper Alloy Coupling for Sectional Ground Rods

Copper Bonded Sectional Ground Rods

Copper Bonded Regular Ground Rods

Type GGH
Ground Rod Clamp
Square head bolt



Type B
Budget Line Ground Rod Clamp
Square head bolt

Type GP 100
Electrolytic Copper Pole Bottom Plates
7½", 10", 14" dia.

Blackburn grounding devices will save you thousands of dollars annually in preventing burnouts of expensive overhead equipment. This complete line simplifies your stocking problem—one source for all your needs. Like all BLACKBURN products they are constructed of high-strength corrosion resistant materials—designed for easy installation and engineered for long-lasting, trouble-free grounding. Always specify BLACKBURN.

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1525 WOODSON RD.

Helps to Eliminate Blank Tapes

Visual test counter, used with magnetic tape recorders in load surveys, establishes latter's proper operation

JAMES E. SMITH JR, Central Testing Laboratory, Alabama Power Co, Birmingham, Ala.

A visual test counter for use with magnetic tape load-survey recorders has been developed by the Central Testing Laboratory of Alabama Power Co. The device determines whether the recorder is operating properly after installation and before removal from the customer's premises. In this manner, it eliminates re-installation of the recorder after tapes, sent in for translation, are found to be blank.

The magnetic tape recorder has two recording heads which impress information on the tape. One is used with a set of contacts driven from the disk shaft of the customer's watthour meter by a geared mechanism. These contacts discharge a capacitor which gives a 3.2-millisec pulse on half the tape.

These pulses provide the "demand" information, and the time between pulses is proportional to the rotation of the meter disk. The other recording head impresses similar pulses on the other half of the tape at preset intervals. The "interval" impulses are impressed in the same manner as the "demand" impulses, except that the capacitor discharge contacts are driven from a cam on the recorder clock mechanism.

After a load survey test is completed, the invisible recorded information is "translated" on electronic accounting machine cards. Seven days of tape recording can be cam on the recorder clock.

The magnetic tape recorder is installed by a field meterman in the watthour-meter socket on the customer's premises, where it registers whr consumption. The recorder's two small neon lamps show the maximum amplitude of the pulses on the tape and whether the recorder is working electrically. As many tapes for translation are blank, a recorder is often re-installed at additional expense.

Each Installer Has Tester

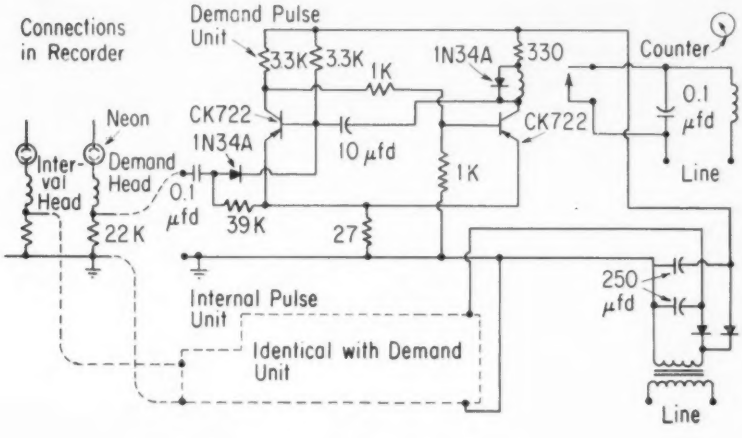
The need for a visual testing device being thus apparent, the unit illustrated was developed and built. The original idea was to install test counters on each recorder, but cost prohibited it. But enough counters were built to assign one to each meterman installing recorders.

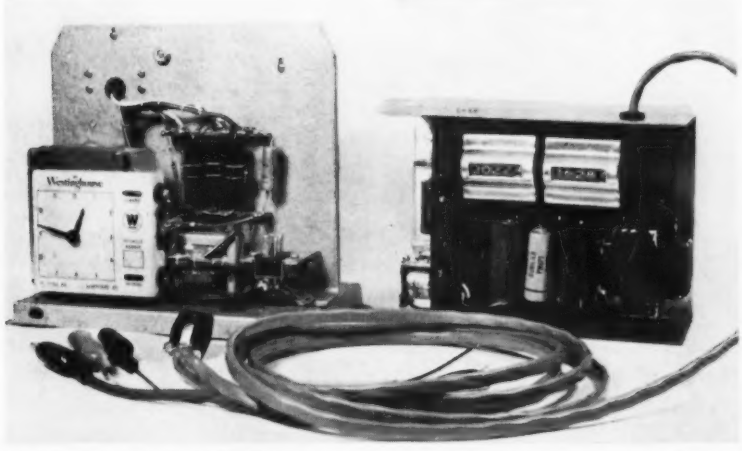
The test counter is connected to the recorder at installation. If it indicates that the recorder is working properly, the test counter is disconnected and the recorder is left operating. At the end of the test the same check is made. If the recorder is operating properly at the beginning and end of a test, the assumption is that it has operated properly during the test.

Commercial digital counters for this application take about 100 millisec and 3 w to operate. As the recorder pulses are 3.2 millisec and the output power in mw, a method to lengthen the recorder pulses and amplify the power output was devised.

Since there are two recording heads impressing information on the tape, there are two separate and identical transistor circuits in the test counter. The circuit is a monostable multivibrator that remains cut off until an impulse is received at

(*Continued on page* 99)





MAGNETIC TAPE RECORDER is shown removed from the test trough and the test counter with its connecting cables. The counter's cover has been removed

For the MOST DEPENDABLE GUY

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Open Helix Loop

AT THE TOP

AT THE BREAKER

AT THE ANCHOR

Actual Size of 35 GDE ⅜

SEE HOW all your guying requirements can be met by applying Preformed GUY-GRIP dead-ends.

SEND for 32-page Application Procedures book, "THE GOOD GUY," and the 24-page pocket-size companion booklet.

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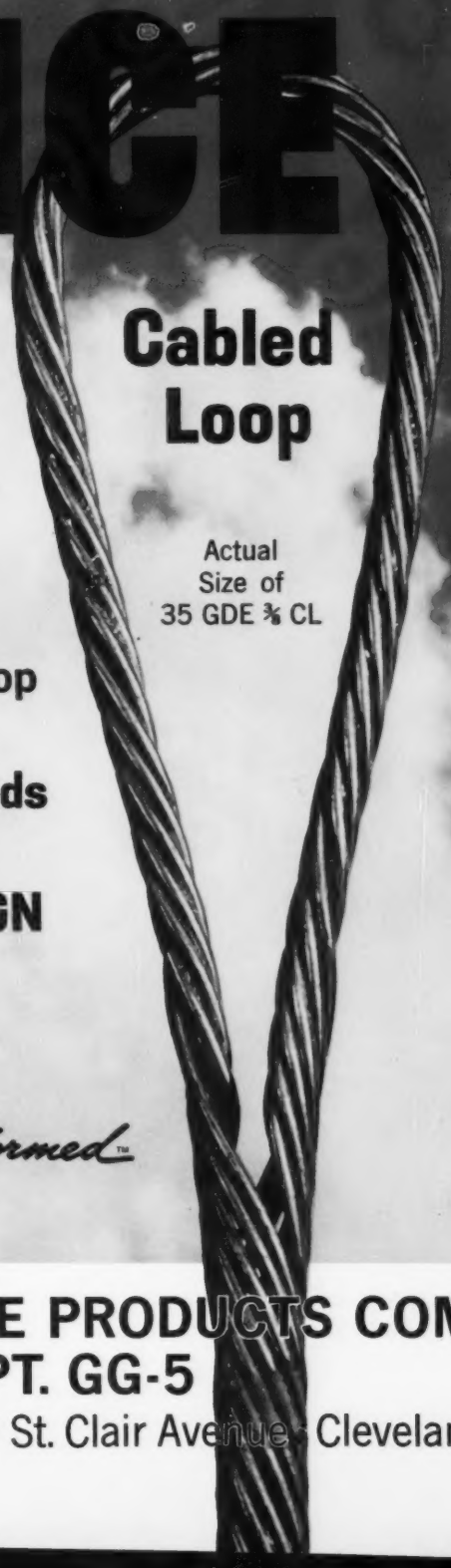
CHOICE



Cabled Loop

Actual Size of 35 GDE ⅜ CL

Standardize on one...
or the other...
or a combination of both.
Choose Open Helix Loop or Cabled Loop
GUY-GRIP dead-ends
TO SUIT YOUR SPECIFIC DESIGN REQUIREMENTS

You can look up to Preformed™

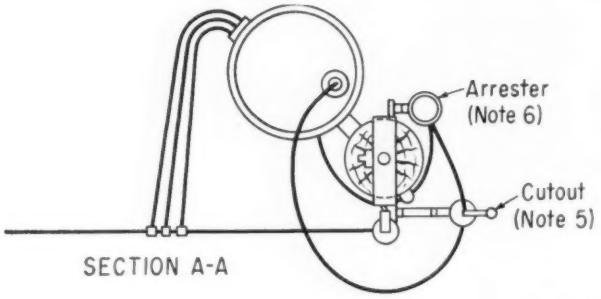
TRADEMARK — "GUY-GRIP"

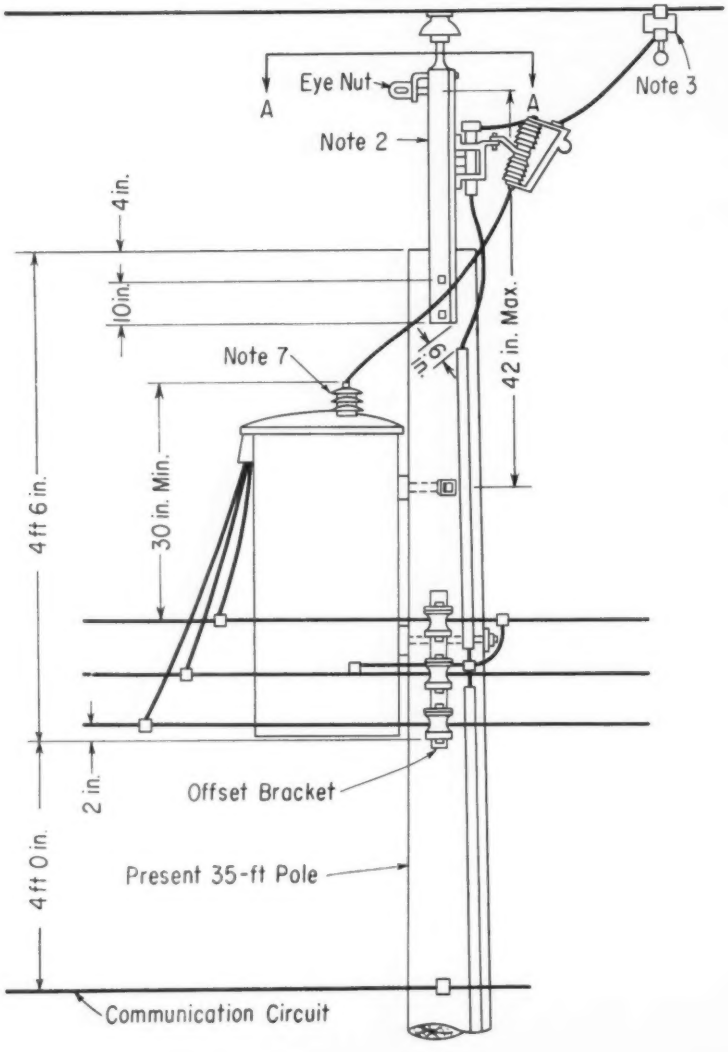
Patented — U.S. Patent Number 2,761,273

PREFORMED LINE PRODUCTS COMPANY
DEPT. GG-5
5349 St. Clair Avenue · Cleveland 3, Ohio

Mount 37½-Kv Transformer on 35-ft Pole

R. L. **WALKER**, Overhead Engineer, Virginia Electric & Power Co, Richmond, Va.





To meet load growth on Virginia Electric and Power Co's existing distribution system, it has been found practical to install a new transformer between two loaded or overloaded ones rather than to enlarge them. Intermediate poles are generally jointly used with the communication company and are 35-ft poles. The cost of replacing a 35-ft pole with a 40-ft pole is about $150.

If the communication company should own the pole, the service to a customer may be delayed because Virginia Electric and Power Co has no control over the communication company's pole replacement schedule. Customers are unwilling to accept the delay involved.

VEPCO engineers have developed a 2-ft pole top extension to support a single-phase vertically-constructed 7.2-kv circuit or a 3-phase 7.2/12.5-kv circuit which is strong enough to be used to hoist a 37½-kva transformer into position for mounting on the 35-ft pole. Two nationally-known pole line hardware companies are making the extension.

It is estimated that the extension is saving about $100 per installation, and quicker service is given new customers. Also, it is sometimes found extremely difficult to purchase 40-ft poles in some classes.

Notes:

1. This drawing is to be used when it is necessary to hang a transformer on an existing 35-ft pole.

2. The 2-ft top extension is used for single or 3-phase circuits.

3. Use compression connector without hot clamp on circuits less than 5,000 v.

4. Set a 40-ft pole for new construction.

5. Mount arrester and cutout on 2-ft extension or, if the crossarm is on the extension, arrester and cutout shall be mounted thereon.

6. Train ground lead from arrester to provide separation from 2-ft steel extension at all times.

7. This installation is for cover-type bushing transformers.

EASY TO SPLICE

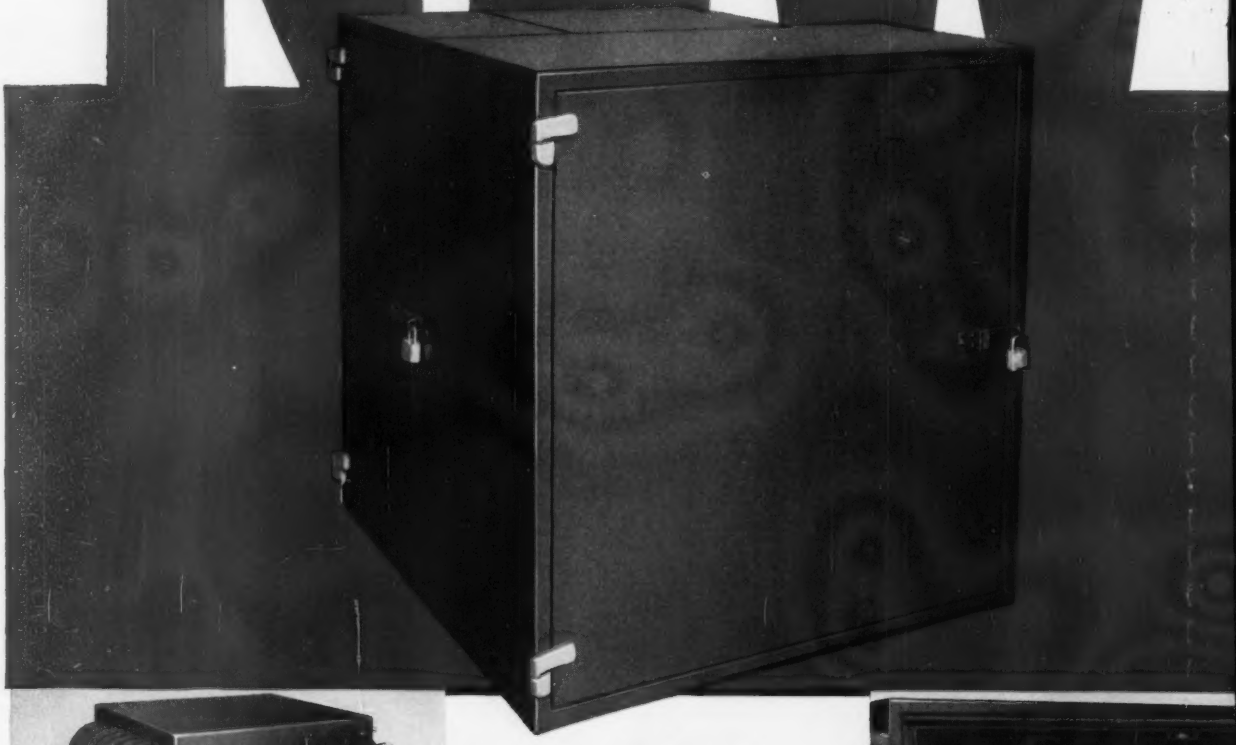
REYNOLDS 5005

high strength, all-aluminum conductor

No steel core makes splicing easier with standard connectors and tools—perfect for "hot line" maintenance. All-aluminum conductor also eliminates chance of galvanic corrosion. Light weight lowers installation costs—it's easier to string, easier to handle. And Reynolds 5005 costs less than any other conductor with comparable properties. Minimum guaranteed conductivity 53.5%. Complete data available from your nearest Reynolds branch office, Reynolds Electrical Distributor, or *Reynolds Metals Company, P.O. Box 2346-EL, Richmond 18, Virginia.*

Watch Reynolds TV shows—"ALL STAR GOLF", "BOURBON STREET BEAT" and "ADVENTURES IN PARADISE"—ABC-TV

NEW



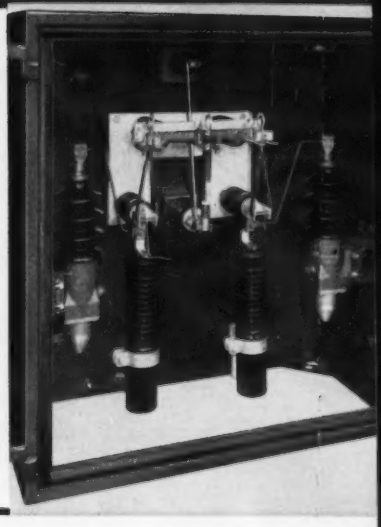
TRANSFORMATION

To provide superior performance under all operating conditions, the transformer portion of the "Unitran" has low exciting current, low impedance and high short circuit strength.

The transformer tank couples with the HV and LV compartments in such a manner that all accessories are inside the compartments.

"Unitrans" are available in voltages thru 15 KV Grd. Y, in conventional types 15 thru 167 KVA and CSP types 15 thru 50 KVA.

To provide interchangeability, a single set of compartments accommodates all sizes of transformers.



Manufacturers: Transformers for Utilities • Industry • Electronics • Factories: St. Louis 20,

MOLONEY "UNITRAN"* FOR UNDERGROUND DISTRIBUTION

PROVIDES . . . APPEARANCE, PERFORMANCE, SAFETY

The Moloney "Unitran" is a new development designed to provide a complete, compact package of transformation, protection and sectionalizing equipment for residential underground distribution systems.

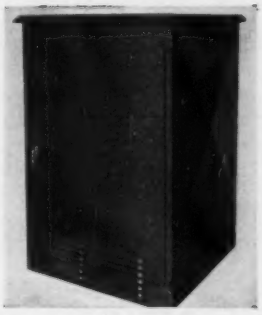
The "Unitran" is a tri-component unit . . . (1) transformer, (2) LV compartment, (3) HV compartment. The basic design emphasizes performance, safety and appearance, thereby making the unit compatible with modern underground systems.

The attractive appearance of the "Unitran" provides an answer to the utilities problem of electric power distribution without overhead lines. Several exclusive features insure safety of utility personnel during installation and maintenance and eliminate the possibility of damage and hazards due to unauthorized entry. The "Unitran" has the same core-and-coil assembly as Moloney Pole Type Transformers; and thus, the same exclusive operating features and superior performance.

*Trademark

Another new item developed for underground systems is the Moloney Transformer Enclosure which provides attractive appearance and safety for standard pole type transformers. Easily assembled, the enclosure is available in sizes large enough to accommodate pole type transformers up thru 167 KVA, 15 KV.

For additional information on either the "Unitran" or the enclosure, request Bulletin #360.



H. V. COMPARTMENT

This compartment has been designed to accommodate lightning arresters, potheads or conduit, and may be provided with a fused-disconnect-and-sectionalizing switch.

This switch, which is designed for loop feeder service, can be operated under load without an external arc by using a commercially available load break tool. Thus, the switch provides for transformer protection and isolation. Other advantages of this external switch include positive visual indication, ease and speed of operation, ease of fuse replacement, and elimination of oil contamination.

L. V. COMPARTMENT

The compartments are fabricated of heavy guage sheet steel and have full width doors equipped with provisions for locking, and designed to be weatherproof and tamperproof. The door hinges are designed to permit the door to be removed quickly and easily.

The LV compartment bolts to the transformer and to the HV compartment and the walls of the compartments isolate live parts of the LV from the HV. Sufficient space is provided in the LV compartment for secondary connections and conduit.

MES9-11

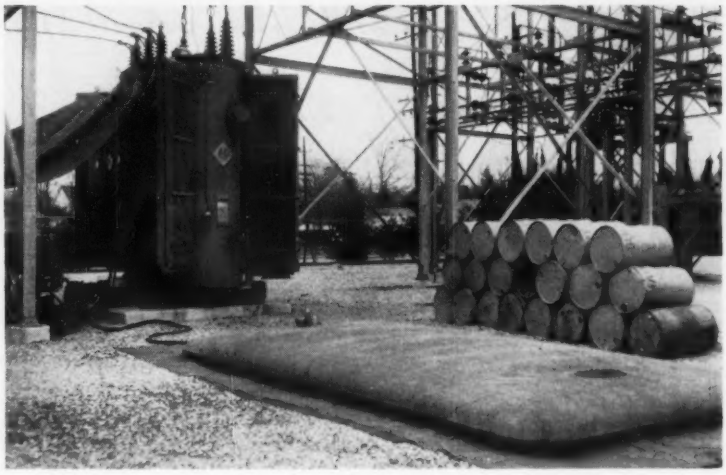
MOLONEY ELECTRIC COMPANY

Mo. • Toronto, Ont., Canada • Sales Offices: All Principal Cities

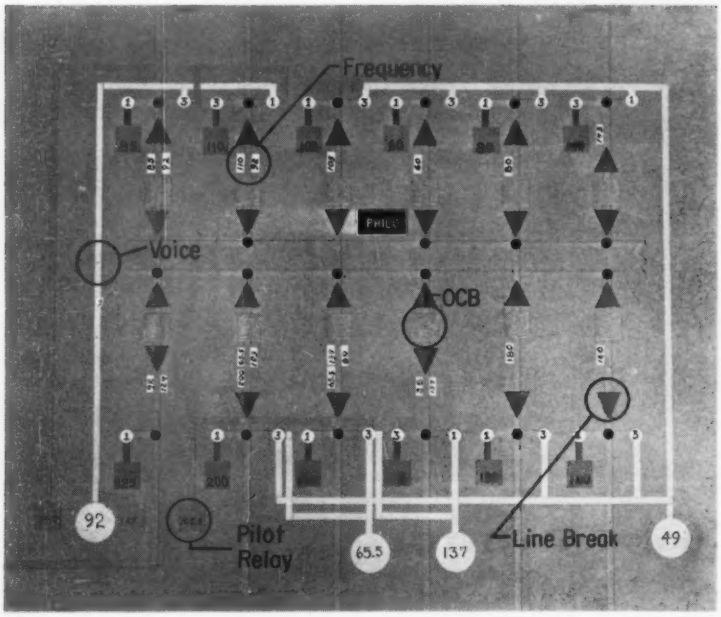
'Pillow Tank' Simplifies Oil Handling

A 3,000-gal collapsible container, shaped like a large rectangular flattened pillow, enables crews of Long Island Lighting Co to perform maintenance on oil-filled substation equipment more quickly and safely. In normal field maintenance or in emergencies, this single 320-lb unit substitutes greater ease in oil handling for the awkwardness of filling, storing and emptying up to 60 drums.

The synthetic rubber "pillow tank," made by Goodyear Tire & Rubber Co, is being used during the repair of oil-filled units such as substation transformers and circuit breakers. Formerly it was necessary to store the oil in steel drums, interrupting the drainage as each drum became full. The reverse process of returning the oil was similar. The removal of 1,500 gal of oil meant juggling around 30 drums and took 2 hr. The same operation with the "pillow tank" is a continuous process requiring only 45 min.



Carrier Current Diagram Helps Maintenance

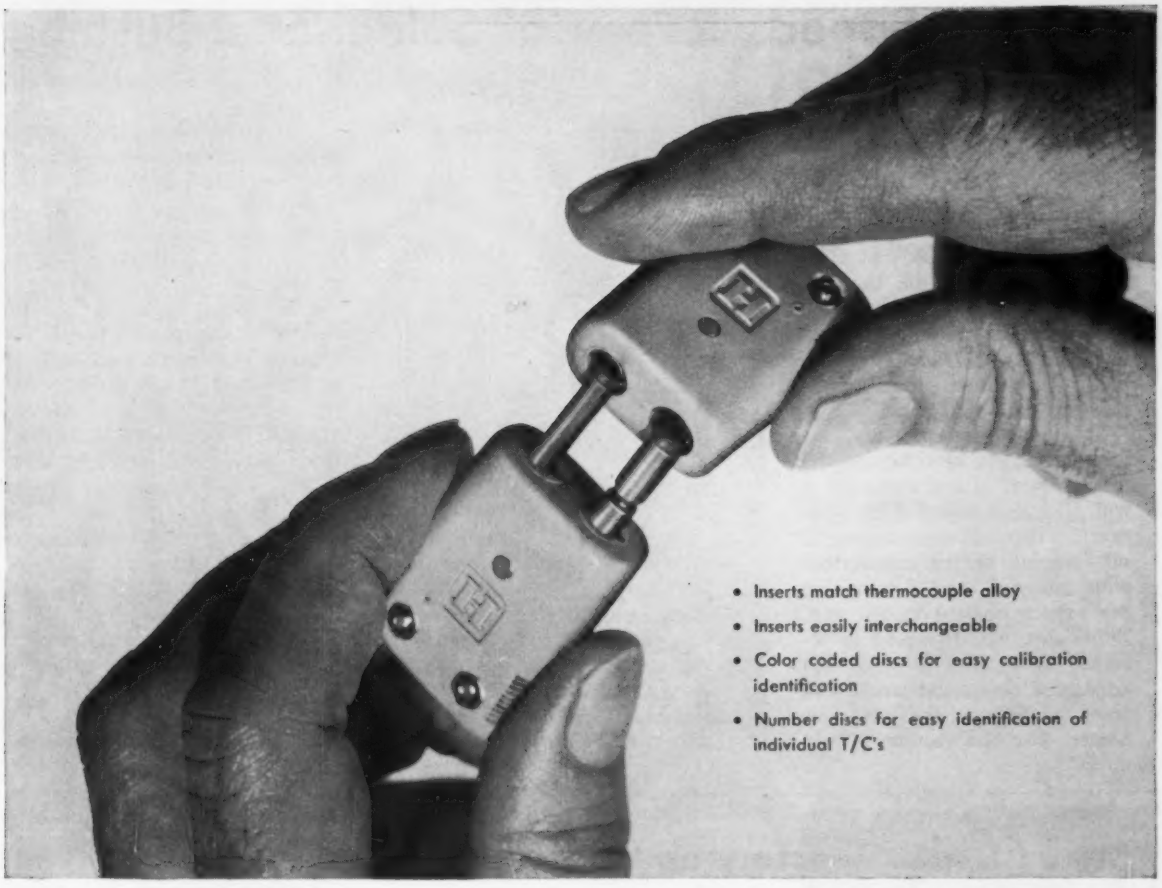


H. E. RUNKEL, Senior Radio Engineer, Ohio Power Co, Newark, Ohio

A visual aid board provides a clearer picture of the carrier current system than can be obtained from one-line diagrams of each component of the system. The board is most useful for maintenance work in that it shows the entire Division carrier current system in relation to the rest of the Ohio Power Co system.

Materials for the board, including a 4x8-ft Masonite board painted "eye-rest" green, cost about $12. Self-adhering tape and standard symbols for dispatch boards were used. Colors and symbols identify equipment, function, carrier current frequency, and transmission line voltage according to a code.

(More Methods on page 74)


• Inserts match thermocouple alloy
• Inserts easily interchangeable
• Color coded discs for easy calibration identification
• Number discs for easy identification of individual T/C's

NEW *QuiK-Konnect** thermocouple components

For accurate, swift, and foolproof connection of thermocouples to extension wire

New *QuiK-Konnect* plug and jack bodies give fast, easy, and foolproof extension wire connections in plant, laboratory or test cell installations.

Inserts have different diameter positive and negative poles, for foolproof connection . . . are extremely easy to remove for field calibration change or replacement. Various tube adapters are available to protect small-diameter thermocouples, and cable clamps can be supplied to protect extension wires from fraying or tearing.

The *QuiK-Konnect* line, in addition to plugs and jacks, includes:

1. Single-jack panel that fits ¾-in. knockout.
2. 4-point jack panel that fits standard electrical outlet box.
3. Multiple jack strips.
4. Custom-built multiple jack panels.
5. *QuiK-Kords** for patch programming multiple jack panels.

You can get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, 21 Penn St., Fall River, Mass.

75th YEAR PIONEERING THE FUTURE

Honeywell

First in Control

SINCE 1885

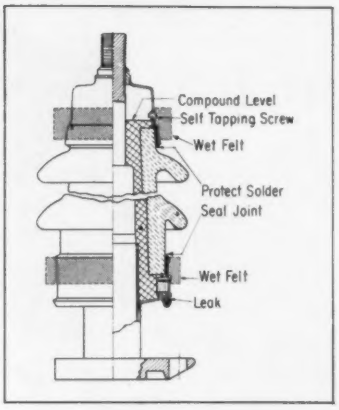
Vacuum Speeds Repair of Solder-Seal Bushing

V. K. CASTO, Transformer Maintenance Foreman, Cabin Creek Plant, Appalachian Power Co, Cabin Creek, W. Va.

Repair of the solder-seal on a compound-filled bushing may be made easily and quickly by placing a vacuum on the bushing. Complete repair of a leak in a 34.5-kv, 4,000-amp bushing on a 77,500-kva 17/138-kv three-phase transformer took but 3 man-hr, and saved about $215.

Vacuum-repair replaces the former practice of removing the leaking bushing and replacing it with a spare bushing. This older practice required the handling of oil, purging of the transformer with nitrogen, and determining the oxygen content in the unit.

Initially, we attempted to resolder the bushing in place, but additional compound would run from the leak as the joint was heated. Use of a vacuum to hold



the compound during heating was suggested. To apply a vacuum to the bushing, the vent screw (soldered over) in the copper cap is removed, and a short length of ⅜-in. copper tubing is sweated over the vent hole. The copper tubing has a ¼-in. tee connected to take a vacuum gage and shut-off valve.

A small portable vacuum pump is connected by a short rubber hose to the shut-off valve. The amount of vacuum is adjusted to keep the compound from flowing out as the solder is melted. As a precaution, do not use more vacuum than necessary or air may be drawn into the bushing.

An oxy-acetylene torch with a medium tip is used for heating the metal near the leak. Rosin alcohol non-activated soldering flux is used. Heat should be kept to a minimum to prevent melting the solder seal.

These joints are extremely difficult to solder in the field. To lessen the chance of melting this seal, areas should be covered with wet rags or felt as indicated in the drawing. After the repair is made, the ⅜-in. tubing is removed, and the vent screws are replaced in the cap and soldered.

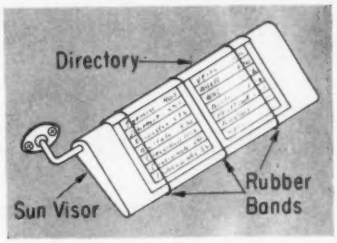
Mount Radio Directory on Visor

ROBERT PALMER, Load Dispatcher, Indiana & Michigan Electric Co, South Bend, Ind.

An accessible, long-lived and double-reference directory of mobile radio units saves time, reduces confusion on the air, and improves relations in the South Bend Division. Any of the 102 radio-equipped cars and trucks now can be easily identified.

The directory lists units in two ways, by number and name, and by name and number. It is designed to be folded over and attached to a car or truck sun visor by three rubber bands. With the visor in the "up" position, the directory shows number and name; in the "down" position, name and number are shown.

Original directories were blueprinted, but two or three weeks exposure in the sun washed them out. Directories made by mimeographing or offsetting will last for months. After about a year of experimenting with this idea, new

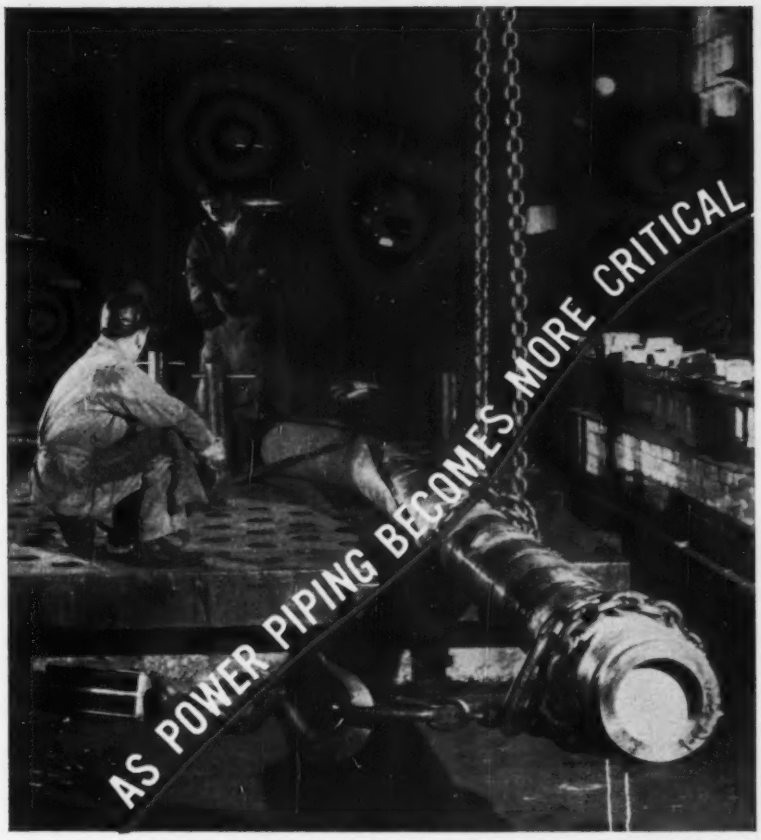


directories were issued to all mobile units in the South Bend Division. The first few months of experience has proved that they save time, reduce confusion, and avoid lost tempers.

String Four Conductors With 40-ft Boom

With a boom extending from a digger carrying four conductors from pole to pole, crews of Clark County PUD strung wire on 6,600 ft of pole line in half a day. With conventional methods, two days would have been required.

Elevation of the road, almost to the mid-point of the poles, made this method possible. The boom is a 40-ft wood pole, on the end of which is mounted a cross-arm and four pulleys. The boom is mounted on a digger.



A length of stainless steel piping is bent to close tolerances at Kellogg's Jersey City shops. Dam in pipe end retains inert gas introduced to prevent oxidation.

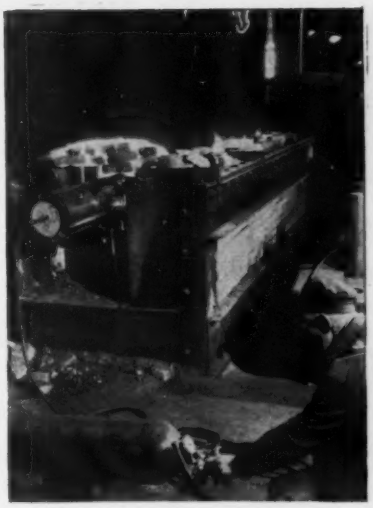
KELLOGG'S PIPE BENDING TECHNIQUES KEEP PACE

Bending stainless, chrome-moly, and carbon steel power piping to meet exacting specifications of length and wall thickness, as well as contour, is a Kellogg skill reflected in a higher quality and lower cost product.

Among the advanced fabricating techniques pioneered by Kellogg at its Jersey City shops is the use of inert gas to purge pipe interiors of oxygen during the heating and bending cycle. This technique assures freedom from internal scaling and provides a clean interior surface.

By its ability to predetermine bending effects such as pipe wall thinning, cross section variations and pipe stretch, Kellogg maintains specification requirements and top quality while minimizing bending costs.

Kellogg welcomes inquiries on its complete design, fabrication, and erection service to the power piping industry from consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.



Operator checks pressure of inert gas being forced through piping during heating to prevent internal scaling. Gas is also retained in the piping during bending.

THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.

A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Co., Ltd., Toronto • Kellogg International Corp., London • Kellogg Pan American Corp., Buenos Aires • Societe Kellogg, Paris • Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas

POWER PIPING—THE VITAL LINK

Procurement & Products

PRICE PROBE ▶ **Federal Grand Jury in Philadelphia has expanded its probe** into the pricing practices of electrical manufacturers. In recent weeks the jury has issued subpoenas covering additional product lines. Presentments due this month may thus turn out to be only the first in a series.

Recently called Grand Jury in Milwaukee has subpoenaed records of some 10 to 12 pole line hardware manufacturers as its first step in probing pricing practices in this field. Earl A. Jinkinson, chief of the Justice Department's anti-trust division office in Chicago, said the Milwaukee probe results from identical-price complaints received from competitors—and not from buyers.

PRICE CHANGE ▶ **A 20% price reduction on secondary network capacitor equipment** has been announced by General Electric Co. The reduction means that the price for a 120-kvar, 216v wye-connected equipment is reduced approximately $4 per kvar, bringing price to $16 per kvar. GE said the lower prices are made possible by improved materials and new manufacturing techniques.

STORES ▶ **Substation Dept storerooms, stocking replacement parts,** are a part of Union Electric Co's regular maintenance activity. Storage of the 4,500 replacement assemblies, consisting of some 25,000 items, is controlled by the Substation Dept. These stores are placed at strategic locations throughout the system for speedy delivery.

Complete stores catalogue is maintained by Illinois Power Co. The coding and classifying is according to type of material and is both alphabetical and numerical. It includes some 26,000 coded items, 20% of which make up 80% of the dollar value in an average inventory.

FLEET ▶ **Compact cars should save about 25% in gasoline costs** as compared to fleets of standard sized automobiles. This was the assessment given to some 100 purchasing agents who attended a special compact car clinic at the national automobile dealers association convention in Washington last week. The clinic was set up by the five U. S. manufacturers of compact cars.

SUPPLIER ▶ **New company, Powerdyne, Inc, is formed** to make 7.5 to 69-kv pole-top switches. The Oswego, Oregon firm is headed by Henry H. Schwager, former engineering manager of Schwager-Wood.

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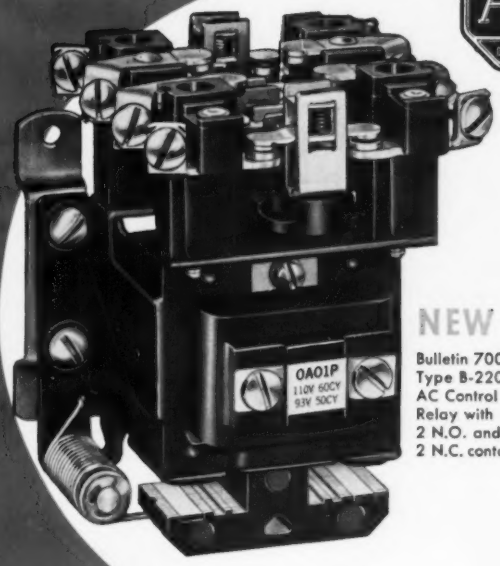
A New Era
in
Relay Life and Reliability



NEW

Bulletin 700, Type B-220A, AC Control Relay with 2 N.O. and 2 N.C. contacts.

NEW

Bulletin 700, Type BX-440A, AC Control Relay can be wired for normally open or normally closed contacts.

NEW ALLEN-BRADLEY BULLETIN 700 RELAYS

Improved features set new performance standards

For years, Allen-Bradley Bulletin 700 Type B and Type BX relays have been preferred for their long life and trouble free operation. The improvements in the new Bulletin 700 Type B and Type BX relays will set new performance standards wherever they are used. Naturally they use the famous A-B double break, silver alloy contacts which always remain in perfect operating condition without cleaning or filing. The cast coil cannot be damaged by the severest atmospheric conditions.

These new Allen-Bradley Bulletin 700 Type B and Type BX relays offer even greater value and greater reliability than ever before—but the price has not been changed.

- **New mechanical design gives at least 5 times greater operating life.**
- **New contact motion provides 10 times greater electrical reliability.**
- **Complete interchangeability—mounting dimensions are unchanged.**
- **New hermetically sealed plastic coil fits Bulletin 700 relays presently in use.**
- **New, stronger, movable contact crossbar—also fits old relays.**
- **New reinforced stationary contact blocks—interchangeable with previous design.**

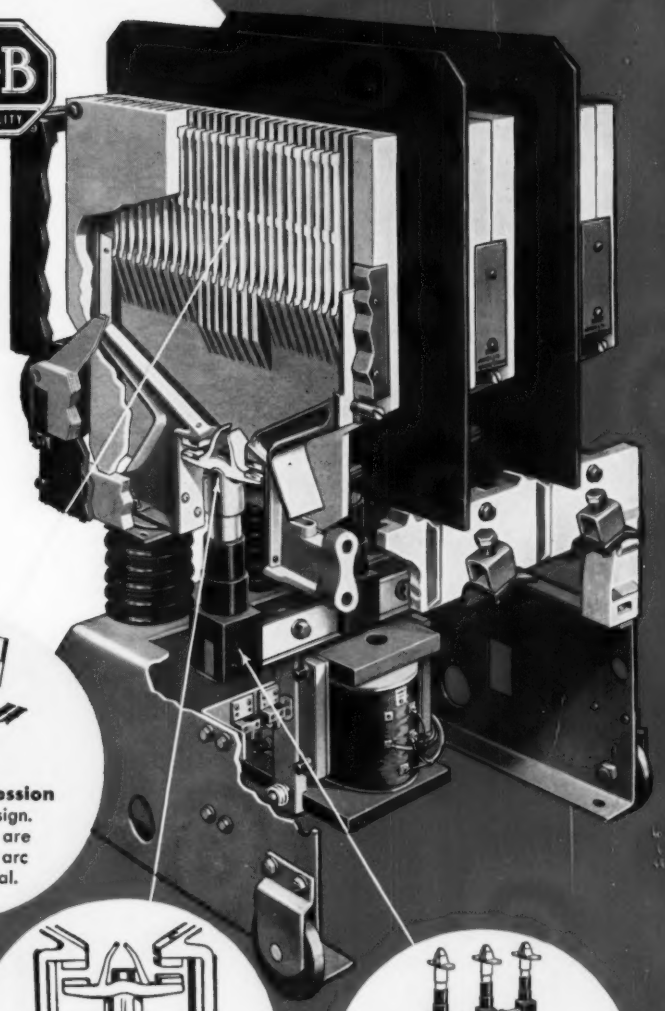
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

3-60-M

ALLEN-BRADLEY Quality Motor Control
Member of NEMA

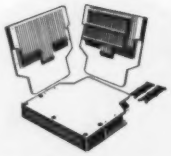
Here's the inside story of industry's

MOST RUGGED HIGH VOLTAGE SWITCH



THIS SOLENOID AIR BREAK CONTACTOR IS THE HEART OF THE A-B STARTER LINE

A tremendous operating life has been built into these new A-B high voltage, air break starters by using the same simple solenoid design—with only ONE moving part—that has proved good for millions of trouble free operations in Allen-Bradley low voltage starters. A-B high voltage starters are made for all types of service and for all types of motors up to 1500 hp, 2300 v; 2500 hp, 4600 v. Send for Publication 6080, today.

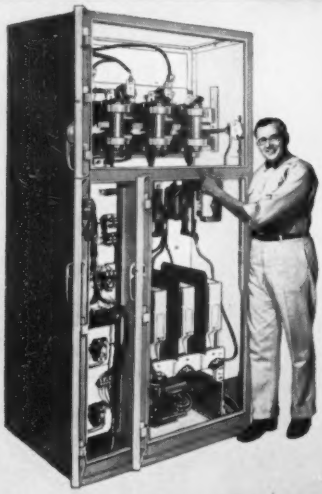


Faster Arc Suppression
New blowout design. Novel arc chutes are molded from an arc resistant material.

Double Break Contacts
Silver alloy contacts never need maintenance. Vertical motion assures uniform contact pressures.

Only One Moving Part
Simple solenoid design eliminates trouble-causing pins, pivots, and flexible jumpers.

3-50-M



A-B High Voltage Starter with Air Break Contactor

Bulletin 1159 high voltage air break, across-the-line induction motor starter in NEMA Type 1 enclosure. All Allen-Bradley high voltage starters are equipped with current limiting fuses with interrupting capacities of 150,000 kva at 2300 v; 250,000 kva at 4600 v.

ALLEN-BRADLEY

Member of NEMA

Quality Motor Control

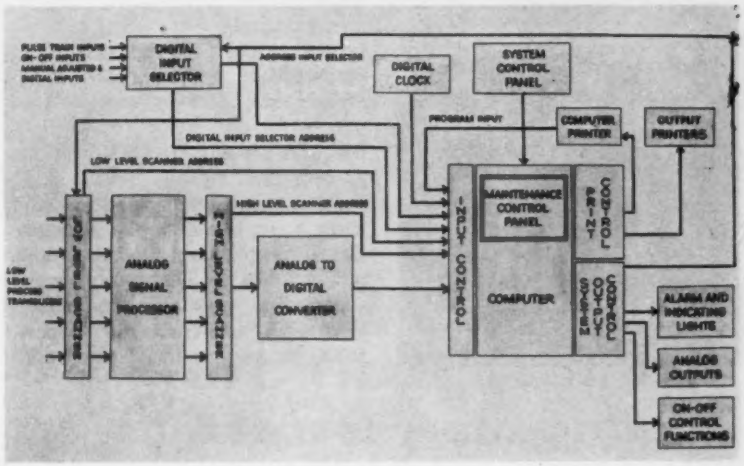
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

New Digital Computer Incorporated in L&N's Control System

First description of the LN-3000 fully-transistorized digital computer (rt) was furnished in a paper presented by two members of Leeds & Northrup Co's research and development department at the Winter Meeting of AIEE recently. The company disclosed it will incorporate the computer into its digital supervisory control systems, and will be responsible for the systems engineering. This includes input-output, computer programming, as well as the marketing function. Philco Corp developed it jointly with L&N.

Public Service Electric & Gas will install the first system using the computer at its Bergen generating station in New Jersey late this summer. It will be used for performance calculations on two identical boiler turbine units and to provide operating guides. Later, the system will be extended to perform closed-loop control functions.

Series 3000 computer system can perform any one of the following three general functions, depending upon the particular on-line application: (1) On-line data reduction and calculation of operating guides. This would permit open-loop control, based upon performance criteria which consist of complex algebraic relationships between the process variables. (2) Program control, with the digital computer used in applications involving a complex series of yes or no decisions, such as process start-up and shut-down. (3) Supervisory computer control, for calculating and setting the optimum reference levels for local analog control loops.

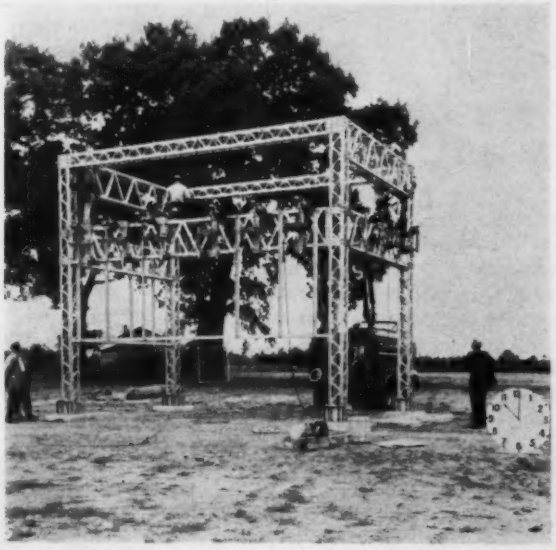


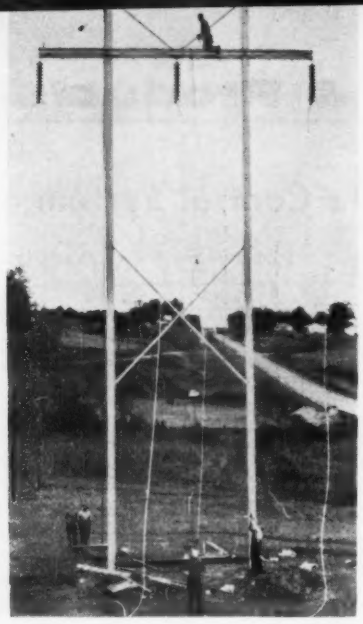
To meet these functions, the computer was designed to be a general purpose, serial, internal binary, fixed point, stored program computer with: single address; 16 basic orders, including square root, which may be modified to provide over 60 operations; takes word lengths of 20 bits plus sign plus parity. Storage features: magnetic drum memory of 8,000 or 16,000 words and rapid access of four words standard.

Prefab Aluminum Substation Is Erected in Record Time

Only 48 min was required to erect this 7.2/12.5-kv substation (right) designed by Line Material Industries of Alrectic prefabricated welded aluminum structural units. As this picture was taken, the last truss beam was being put into position at Americus, Ga.

Linemen of Sumter EMC Cooperative ground-assembled various sections of the 15x20x19-ft structure, then started their record-breaking job of erecting it. Utility engineers standing nearby clocked the process with amazement.



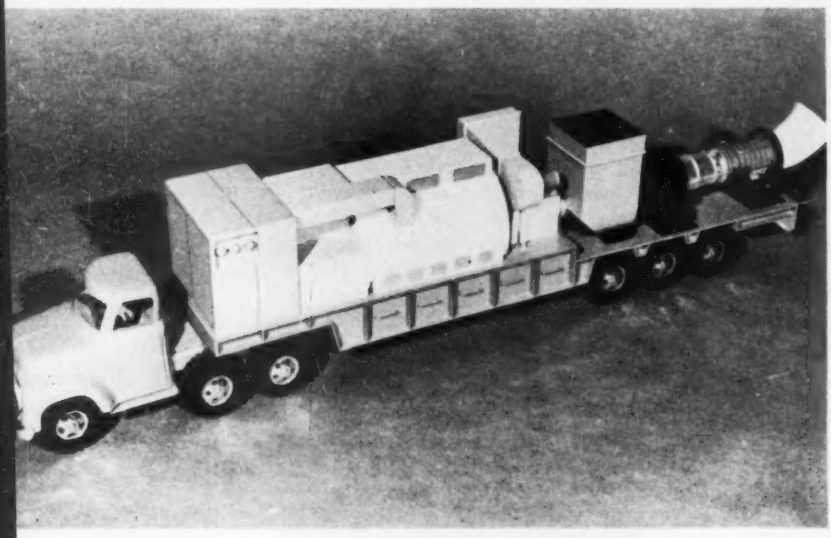


Alcoa Designs H-Frame Towers

Designed by Aluminum Co of America, this experimental all-aluminum H-frame electrical transmission structure (left) has satisfactorily passed performance tests on the Nantahala Power & Light Co system. Alcoa structural engineers prepared the design as part of an investigation of tower materials and designs for one of the 161-kv lines which Alcoa proposes to erect for its own use.

After conductors and ground wires were installed, the structure was tested for several combinations of the following loads: total transverse load, 7,000 lb; longitudinal load at any one conductor support, 5,000 lb; vertical load at any conductor support, 1,500 lb; longitudinal load at any one ground wire support, 2,900 lb.

There are several other phases of the company's work in developing lightweight, corrosion-resistant aluminum towers for use under adverse operating conditions. Alcoa has been working recently with Portland General Electric Co in supplying tubular aluminum crossarms for wood H-frame towers. It is also developing for another western utility an all-aluminum H-frame tower, to be installed in difficult-to-reach areas. Aluminum double-circuit towers are being designed and fabricated for the lines of several major utilities.



Ultra-Lightweight Turbines Ready for Land, Marine Use

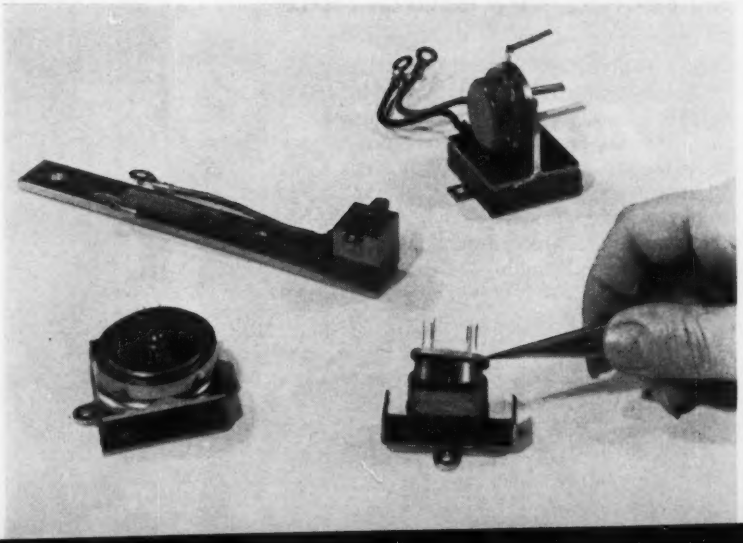
General Electric is introducing a line of 50 to 20,000-shaft-hp ultra-lightweight gas turbines with high power-to-weight ratios.

One of two models presently offered is a generating package mounted on a semi-trailer. With aluminum shell removed (at left) this 7.5-Mva, 20,000-shaft-hp unit exposes: aircraft-type gas generator at rear, aerodynamically coupled to turbine. Spinning shaft drives a conventional electric generator (large white unit in center).

The other model, with 900-shaft-hp, is also a mobile power unit for emergency power generation.

Thermoelectric Cooling Devices Available

Westinghouse Electric Corp has announced it is producing for the first time a line of thermoelectric cooling devices (right) for industrial and military applications. A series of thermoelectric modules have been designed as electronic component coolers and for other applications in which compactness, silent operation with no moving parts, and a controlled cooling rate is desired. (*More Procurement & Products, p* 82)



In the heart of Lake Charles...

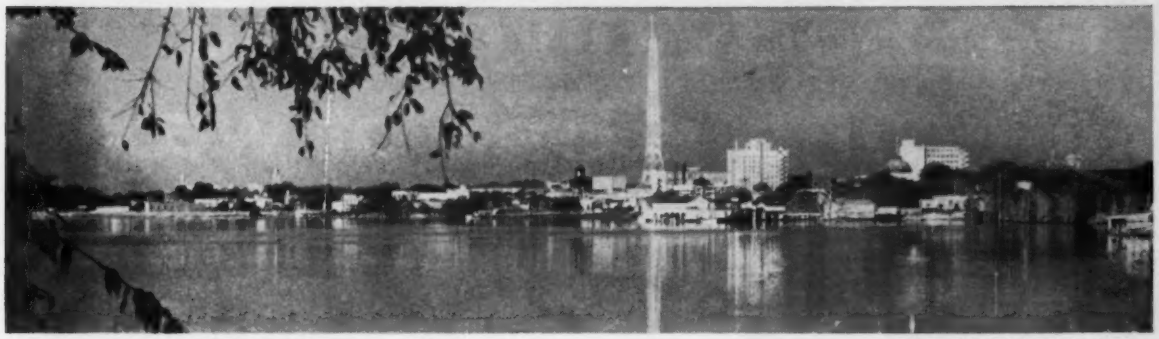


Photo by Rybiski, Lake Charles, Louisiana

Lake Charles, Louisiana ... city on the move. Industrial hub of the Gulf Coast. Major port and center of Louisiana's petroleum industry. Big producer of chemicals. Home of the world's largest rice mill. Good home, too, to 70,000 people.

In Lake Charles, the demand for power grows—steadily, in the long run, but with daily and seasonal demands varying from light to heavy. These fluctuating demands emphasize the importance of automatic voltage regulation to maintain steady voltage under all load conditions. That's why the Gulf States Utilities Company has recently installed a 7500 Kva Wagner Load Tap Changing Power Transformer in the downtown commercial area.

This compact unit utilizes a new design in the load tap changing mechanism, which has been greatly simplified to provide quiet operation and long operating life with extremely little maintenance.

Constant research and development have kept Wagner up front in transformer design for more than 65 years ... made Wagner a leader in power planning. So, remember this:

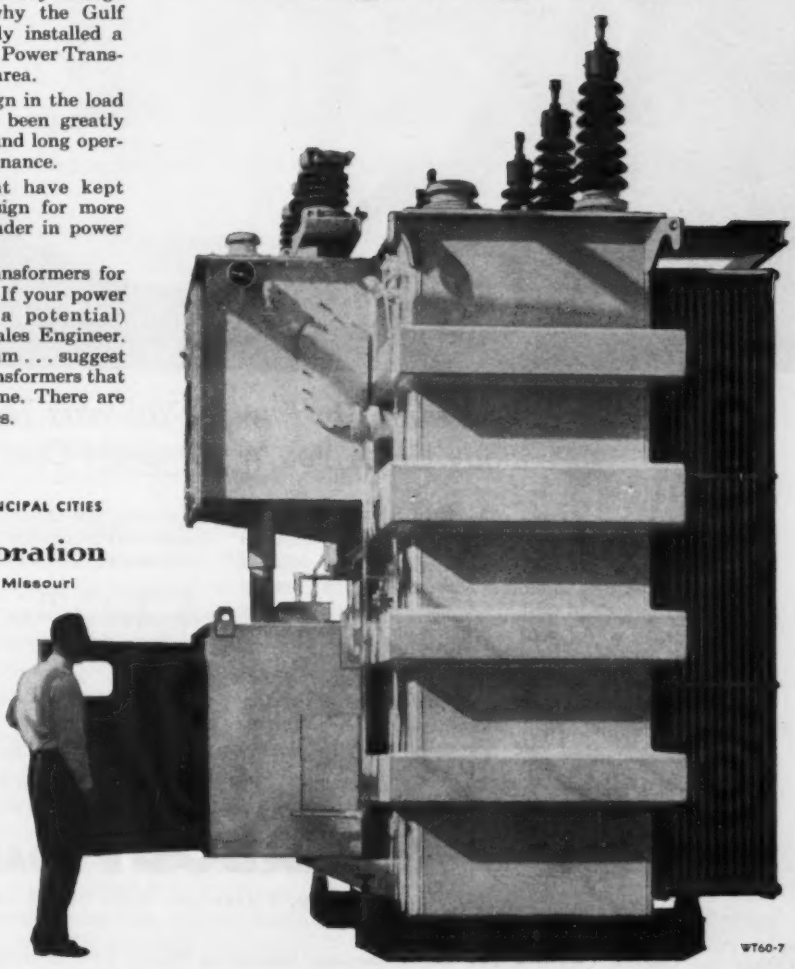
Wagner makes a complete line of transformers for industrial and power company needs. If your power needs present a critical (or even a potential) problem, call your nearby Wagner Sales Engineer. He'll help you plan your power program ... suggest Wagner power and unit substation transformers that will meet your needs for years to come. There are Wagner branches in 32 principal cities.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6456 Plymouth Ave., St. Louis 33, Missouri

This Wagner LTC TRANSFORMER Assures Automatic Voltage Regulation

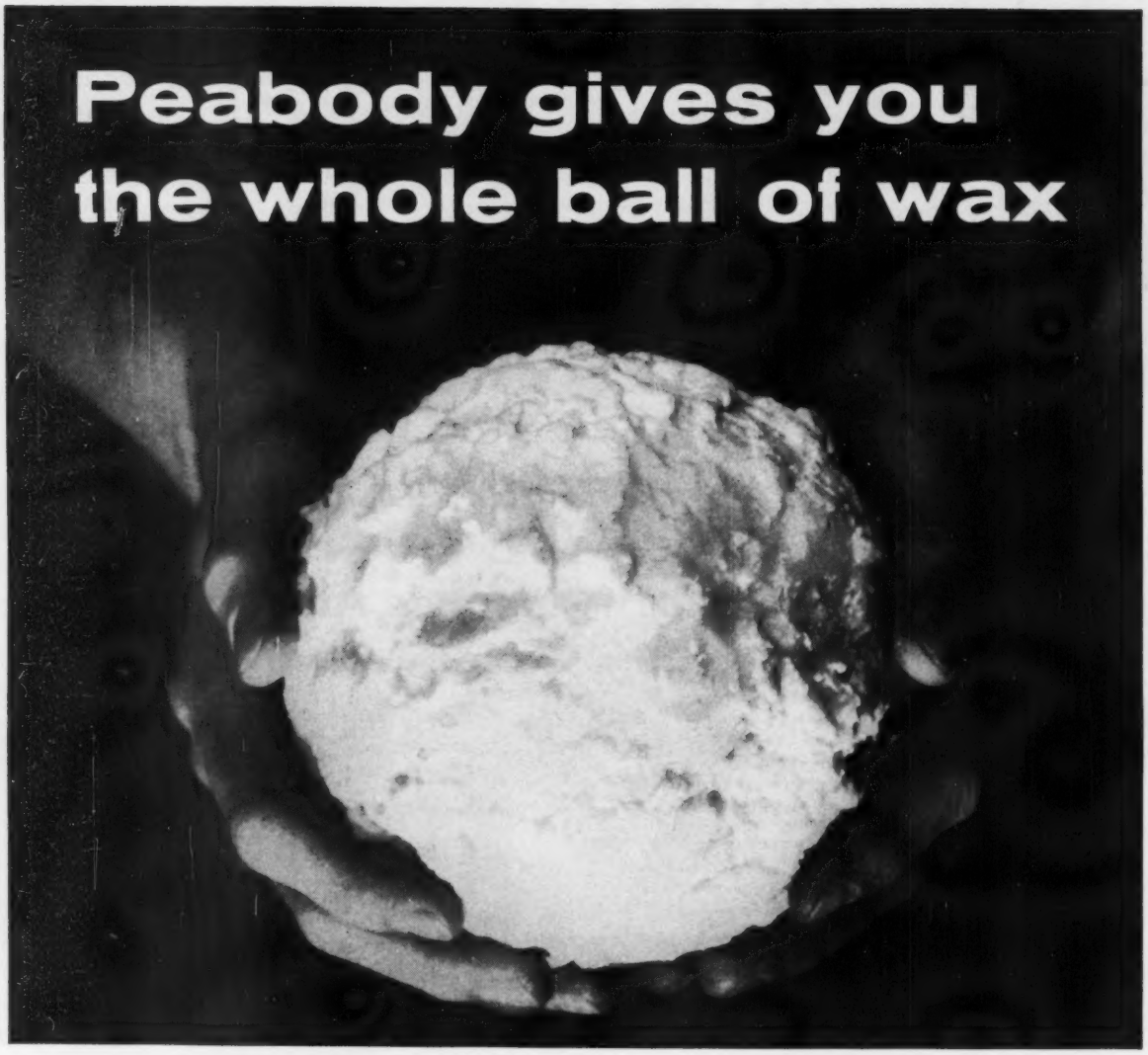


Wagner magnetic amplifier control equipment senses any voltage fluctuation in the line and automatically regulates the voltage to meet the demand.

LIVE BETTER ELECTRICALLY

WT60-7

Peabody gives you the whole ball of wax



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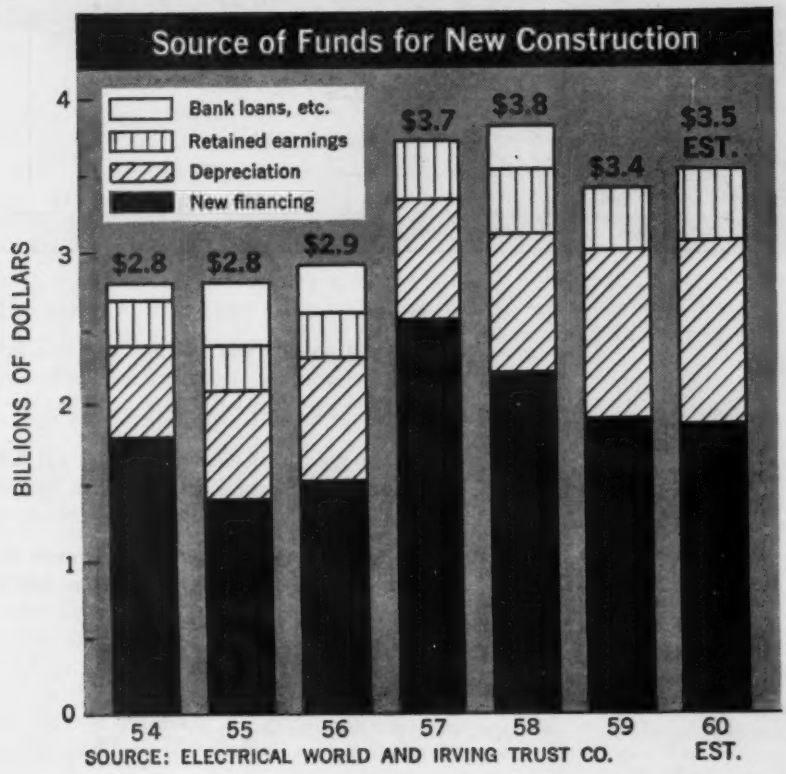


Report on **Finance**

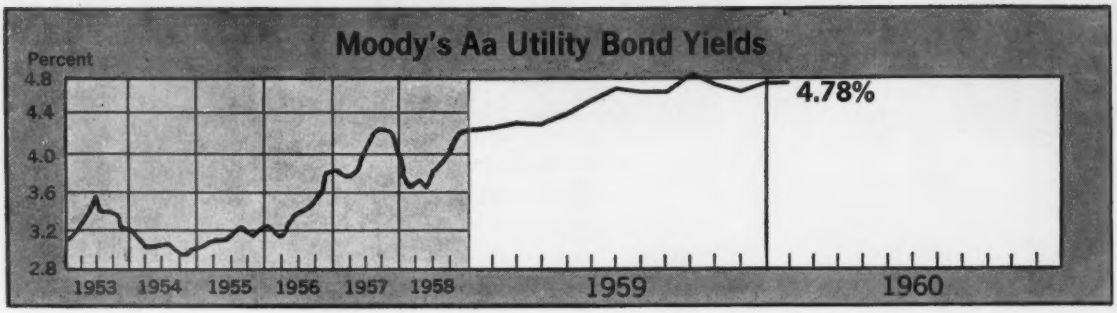
What Will Money Cost in '60?

Wall Streeters are contemplating 1960 with a puzzled optimism. At the turn of the year the Dow Jones industrial average crested at the highest peak of all time. Then a few days later it took the steepest dive of any January in 30 years. Meanwhile, brokers waited impatiently for the "booming 60's" to check in. And in the bond market, full of surprises, lenders agreed to easier interest terms. What does this portend for the utilities?

Electric utilities will probably spend about $3.5 billion this year for new construction. About $1.9 billion of that will come from new security issues. This demand for new funds comes at a time of uncertainty for investors and businessmen alike. How difficult will it be to raise this $1.9 billion and when is the best time to go after it? Investors' attitudes, the health of the economy, and the role the government decides to take, will all play a part. And all are uncertain at this time.

Consider the recent past. In October, 1958, utility bond yields edged ahead of stock yields, and have stayed there ever since. It was as though investors threw away the textbooks, deciding bonds were riskier than common stocks. Investors' motives, though, were logical. One was the increased emphasis on capital gains, spurred on by the tax laws and a strong "Bull" market. The other—and widely regarded as the real culprit—was inflation, and its threat to the safety of fixed income securities, such as bonds. Inflation, or the lack of it, may have much to do with financing in 1960.

Bond Yields: Off the Plateau?



Chances are nobody will win any bets that inflation is finally done rampaging through the economy. But there are positive signs that inflation may no longer be the villain it once was. The facts line up like this:

• **First, the steel settlement was much less inflationary** than we thought. The 3½% per year increase the steel men brought home almost (but not quite) matched their own gains in labor productivity since the last strike in 1956.

• **Second, there's not enough money around to feed a real inflation** right now. And there's not likely to be, McGraw-Hill's Dept. of Economics predicts. Despite a slight tapering off of interest rates, money is still in big demand. Although the Fed is still maintaining its discount rate at 4%, a hike is almost certain once the economy starts picking up more speed. And chances are it still may, despite the rumblings. Furthermore, higher interest rates overseas are causing some worry. A defensive interest hike by the Fed may be its best weapon to induce foreigners to keep holding their U.S. dollars.

• **Third, the federal government** is riding into Fiscal '61 with a sobering $6 billion surplus. If a spendthrift Congress doesn't make off with this prize it means a big drain on the money supply. Some Wall Streeters are even betting that a $6 billion surplus might stop inflation in its tracks, at least for a while. It could even cause a little price deflation, just as it did in 1957—the last year the government rang up a small profit.

The "Soaring 60's" will certainly have their effect on financing this year. The rip-roaring first half was supposed to be propelled by brisk auto sales and inventory buildups. So far, both have fizzled. But despite warnings of "deflationary tendencies" by Federal Reserve Chief William Martin, a gloom has not yet settled over Wall Street. The outlook, now, is for a more leisurely, but healthy, upsurge. A steady, but less spectacular, growth through the whole year. Actually, these signs are not necessarily ominous. Businessmen, and the market, generally have the sniffles in January and February. It simply isn't a healthy time of the year for industry. The first hint of spring should tell of things to come—budding profits, or the doldrums.

What's Ahead in the Bond Market?

How high can utility bond yields go? Despite a recent dip, yields still sit on a lofty plateau—in fact, near a 30-year high. It would take a mighty push indeed to jack yields up still higher. Certainly a steep climb, as in in past two years, is unlikely. But once business starts humming, interest rates may edge still higher. How far can yields go? We haven't seen anything, one Wall Streeter believes. He remembers how, back in 1920, high grade utility bonds went begging for buyers at 8% interest. But that, he admits, is unlikely today.

The government, as often in the past, is the dark cloud hovering over the bond market. The Federal Reserve discount rate still sits at 4%. With the prime rate at 5% (the rate banks charge the most trusted borrowers) there is a considerable gap between these figures. A further hike in the prime rate (which could come with the business upturn) may well bring with it a hike in the discount rate as well. That means higher interest for all.

In 1959 the Treasury sold only short term governments because of its long-term interest ceiling. The big mystery is whether it can convince Congress to raise its long term rates (now at 4¼% for bonds maturing in over 5 years). If Congress concurs, the government could enter the long term market with offerings that directly compete with utility bonds. Congress has repeatedly ignored Eisenhower's pleas to raise interest rates, but there could be a compromise. One such compromise, a high interest issue totaling less than 2% of the national debt, would permit the Treasury to float some $5.8 billion in long term bonds at competitive rates. And it is well to bear in mind that if the Treasury got a green light on competitive rates it could hardly fail to sell in the long term market, after all the fuss that's been raised.

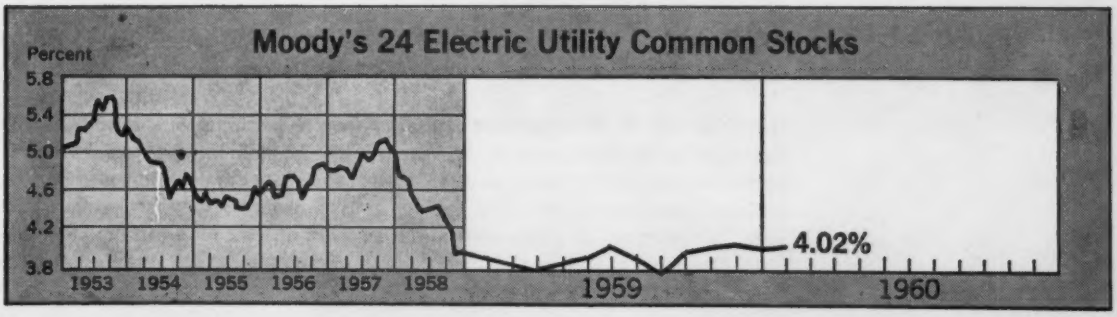
In the end, supply and demand for funds creates high or low interest rates. On the demand end, there are some factors tending to push rates down—more internal financing this year by business, a slowdown in new housing starts, and no large increases in new financing over last year, especially by the utilities. But other factors offset this—notably the business boom that has been forecast, at least for the first half of this year. These factors just about balance each other—if the boom comes along as predicted.

One survey shows long-term money demand this year at about $27.7 billion. About 14% of this demand will come from tax-exempts that are non-competitive with utility issues. On the supply side, it looks like only $26.6 billion will be available for long term borrowing—about 62% of it from the big institutional investors, according to the study, made by Girard L. Spencer of Salomon Bros. & Hutzler.

This shortage of long money—a 4% gap between supply and demand—means the upward pressure on interest rates shouldn't ease much in the near future. If the government is able to go into the market with some long issues, the upward push will be even stronger.

The facts, however, dispute the theory. Actually, interest rates have been moving in the opposite direction thus far. Both triple "A" and double "A" utility bonds have been offered with moderate declines in yields since January. Outstanding bonds, too, have risen in price. On Feb. 1, *Wall Street Journal's* tabulation of 12 new utility bonds showed average yield on current bids was 7 decimals (0.07% per annum) below average yields at offering. There is grow-

Stock Yields: Out of the Valley?



ing evidence that money is easier to get. Rates for 30-180 day bankers acceptances dropped ¼% on Feb. 8th, to a range to buyers of 4⅜% to 4⅝%. On Feb. 9th, 90-day commercial paper dropped ⅜ percentage point to 4¼%.

What does this mean for utility bond issuers? Despite the recent tapering off in yields, there is still no positive reason to believe this will be a long-term downtrend. The discount rate may still go to 4½%. And a Congressional move to solve the government's long term borrowing problems could be a significant threat to interest rates. The risks of waiting to issue debt (to take advantage of possible lower yields) seem to about equal the risk of issuing now. The bond market has not established any definite trend, either up or down, and there seems to be little reason to accelerate long term debt issues beyond normal offering dates. The big question now seems to be the boom. If it materializes, yields will almost surely head upwards.

Where Are Stocks Headed?

Has the snorting bull market run its last uphill dash? There is confidence in Wall Street that the bull, now 12 years old, is still far from the coupe de grace. The January tumble, down to September 1959 levels, is viewed as a "technical" adjustment by many. The "technicians" point to the market blues as typical of this time of year. Furthermore, the market has not yet reached a strong base from which a healthy spring upsurge will grow, they say. In fact, there is some opinion that the lower limits of the 1960 trading range are now being set.

But it is equally important to note that the fund managers don't agree. They have been cutting back their common stock buying rather sharply, switching instead to defensive, fixed income securities. It is hard to draw conclusions from any of this activity, though. Actually, of all the business indicators, the stock market is one of the least reliable. The market correlates with industrial activity only about half the time.

Utility stock performance last year points up an interesting fact. Stock yields rose, with Moody's 24 utility commons going from a 3.87% to a 4.01% yield. That is a 4% upward yield movement. Logically, new issues should have sold for that much less as a consequence. Yet, new issue prices fell only 1%. It's explained by an increase in per share earnings in 1959, which compensated for the lowered yields.

In January, price earnings ratios were off for the market as a whole—down 10% on Moody's industrial average, off 8% on *New York Times* combined 50 stock average. But the outlook for utility issuers is still bright. Utility stocks came out of the tumble almost unscathed—prices fell about 1%.

Common money costs for utilities will probably hold near the 6% level (before expenses) on a price earnings ratio basis, at least for the time being. This 6% before-cost rate is one of the most attractive utilities have come across in 30 years. And even if stock prices still decline generally, the expected increases in per share earnings for the industry could maintain utility common prices at a higher level than the market generally. Thus, it looks like most utilities can count on raising 6% common money for most of 1960—a pleasant prospect.

It may be wise to raise common capital as soon as possible, with conditions still uncertain in the stock market. In fact, it might be prudent now to raise equity capital needed as far ahead as early 1961. The market may climb still higher, making issue costs lower. But a delay in issuing seems to offer more risk of loss than prospect of gain—with a very important exception. Companies that anticipate a very healthy rise in per share earnings may well hold off for the better prices this news will bring.

NIAGARA

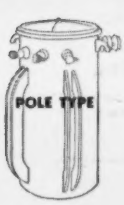
TRANSFORMERS

"No exceptions. Not a single Niagara Transformer reaches the shipping platform without being thoroughly tested."

At Niagara, product quality is watched all along the line... starting with raw materials. To win an "ok" for shipment, completed transformers must pass rigid performance tests. Not only do they conform to NEMA and ASA standards, but in many ways exceed them.

Designed with liberal overload capacity, Niagara Transformers are produced for practically every service through 10,000 kva, 69,000 volts. Write for Bulletin 139. Niagara Transformer Corp., P.O. Box 23, Buffalo 25, N. Y. Representatives in principal cities.

"Before they leave here, every one gets a stiff test."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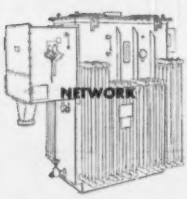
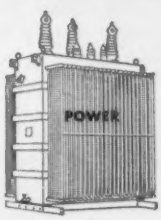
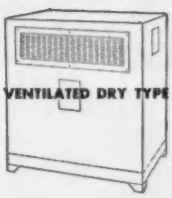
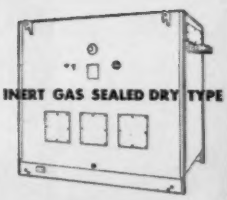

NETWORK

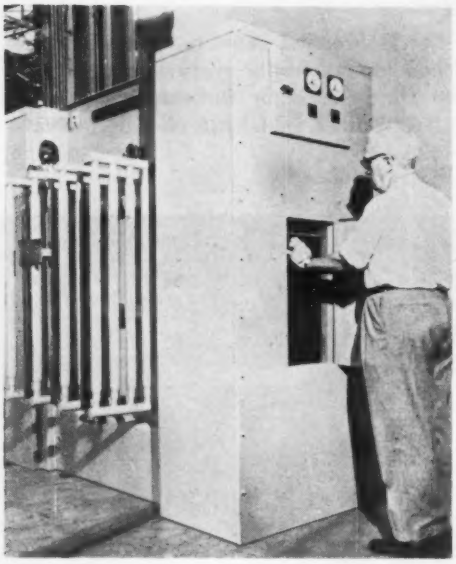

POWER


VENTILATED DRY TYPE

UNIT SUBSTATION


INERT GAS SEALED DRY TYPE

(For further information refer to Readers Service on page 90)

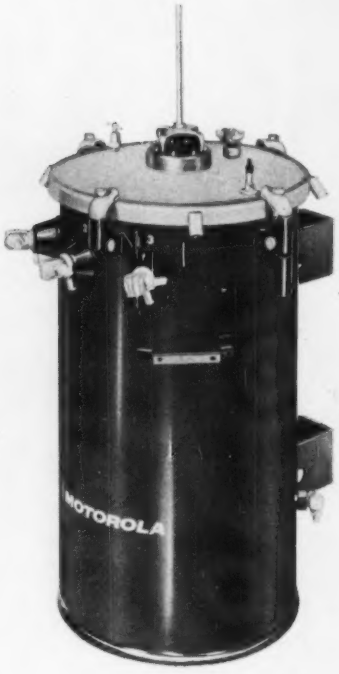


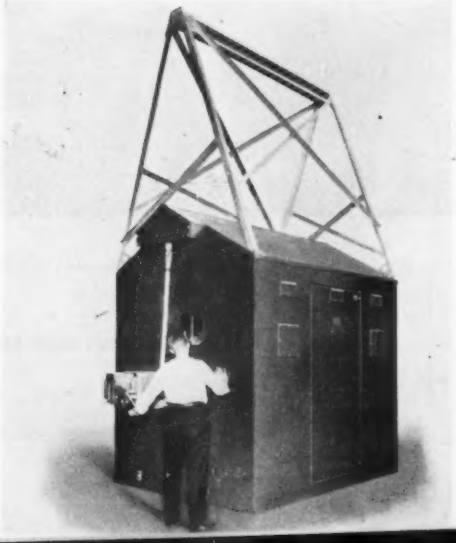
Unit Substation . . .

. . . for industrial plants, commercial buildings, hospitals, and school buildings is available. The Integral Distribution Centers use four different transformer types: open and sealed dry-types, 300 kva and above; and oil and Pyranol-filled, 112½ kva and above. The units incorporate an incoming cable termination compartment or hv switch, a transforming section, and a low voltage section containing breakers or feeders to meet requirements of all light to medium load applications.
General Electric Co, Schenectady 5, N.Y.

Remote Indicator . .

. . . identifies and locates power outages or emergency conditions on a utility network automatically. The signal transmitter (right) has a radio transmitter, power supply, and tone coding device. Decoder-printer (left), connected to radio base station output, translates tone signals to numbers typed out by the printer.
Motorola, Inc, 4501 W Augusta Blvd, Chicago 51, Ill.

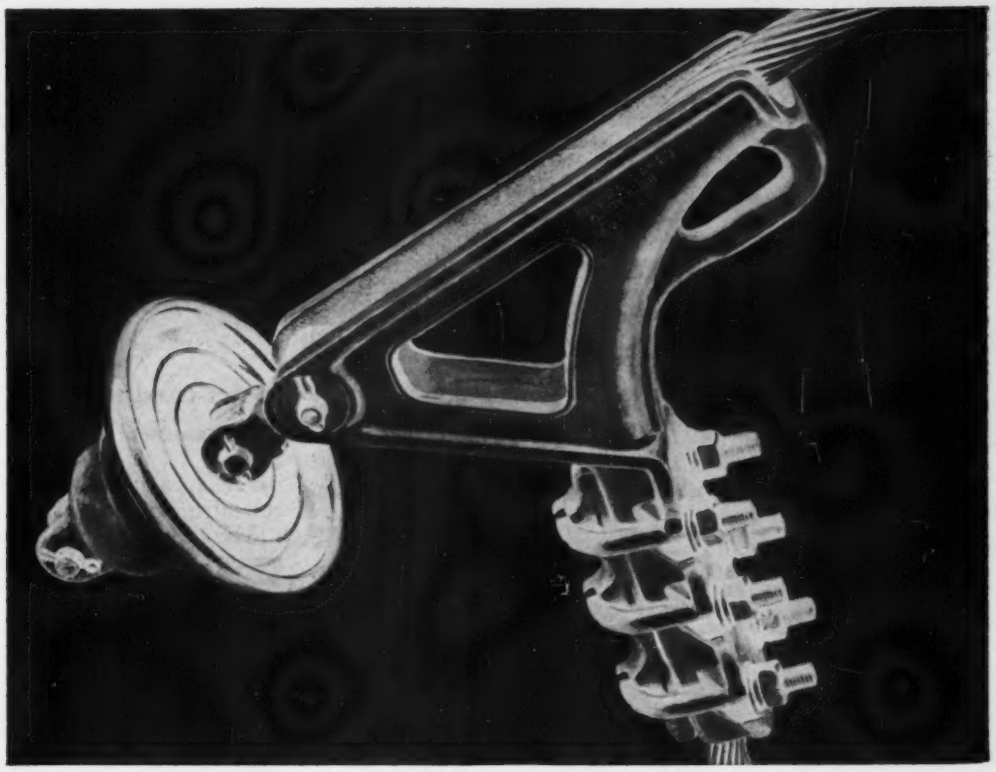




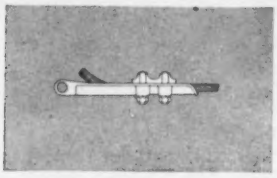
Switch House . . .

. . . has three-phase disconnect switch with enclosed-type interrupters, rated 600 amp at 34.5 kv. Provision is made for potential transformer, lightning arrester, three incoming lines, and three load-side bushings. Locked mechanism, bolted doors, and sealed windows provide safety. The switch is motor-operated by a mechanism attached to either the right or left side of the house.
Delta-Star Electric Div, H. K. Porter Co, Inc, 2437 Fulton St, Chicago 12, Ill.

(*More New Equipment on page* 90)

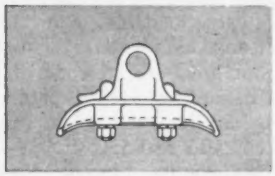


WHAT'S IN A BETHEA CABLE FITTING?



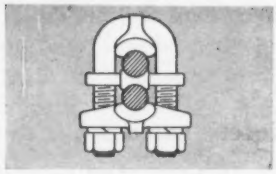
QUALITY—

A Bethea transmission size strain clamp (ADE-27) picked at random from a production run was tested by Pittsburgh Testing Laboratory for ultimate strength. This clamp is RATED at 35,000 lbs. It BROKE at 50,500 lbs.



DESIGN—

Bethea's short quadrant dead end series, designed and produced eight years ago, has been imitated but its effectiveness has yet to be equalled.



PRICE—

Bethea has set the pace in the industry for the past ten years.

Broad claims? You bet, but we'll be happy to prove them. Write for samples, catalog and Pittsburgh Testing Laboratory Data.

QUALITY CABLE FITTINGS

1950 1960
10th YEAR OF SERVICE

A BETTER WAY FROM . . .

Bethea
COMPANY, INC.

P. O. BOX 1407 — BIRMINGHAM, ALABAMA

Readers Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

GE ..... Substation ☐
Motorola ..... Indicator ☐
Delta-Star ..... Switch House ☐
Bulldog ..... Bus Duct ☐
Pacific Mercury .... Warning Lights ☐
Yokogawa ..... Tester ☐
Westinghouse ..... Indicator ☐
Harrington ..... Latches ☐

OTHER

_____

_____

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countires or to competitive manufacturers.

NAME _____
TITLE _____
DEPT. _____
COMPANY _____
ADDRESS _____

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_____

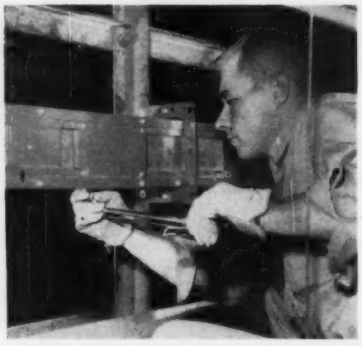
FOR:

Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

FEBRUARY 22, 1960

Bus Duct System . . .

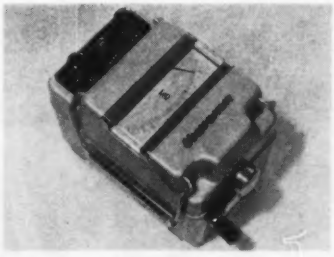
. . . is flexible, easily installed, and has plug-in power take-offs at any place along the line without disconnecting the main power line. The system (XL Bustribution Duct) is capable of withstanding extreme electrical and mechanical stresses,



and has low voltage drop and a simplified joint with a low number of bolts, effecting installation economy. It is available in ampere ratings of 225 to 1,000 amp and voltage ratings through 600 v.
Bulldog Electric Products Div, I-T-E Circuit Breaker Co, Box 177, Detroit 32, Mich.

Warning Lights . . .

. . . feature 1-in. wide light circle around rim of 5 and 7-in. dia flasher lights. Available in amber and red, the lights' flasher has rates which are adjustable to meet specific state highway requirements. Both models have "Solarstat" for automatic turn-on at sunset and turn-off at sunrise.
Pacific Mercury, 1332 Leadwell, N. Hollywood, Calif.

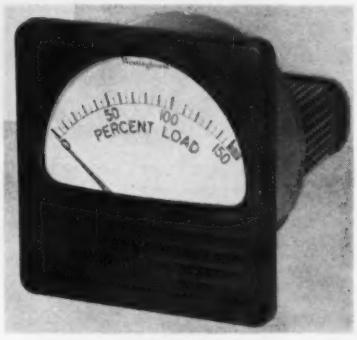


Insulation Tester . . .

. . . provides direct reading of insulation resistance of electrical machinery, wiring or cable. The Model L-5 miniature tester comes in five ratings from 100 v, 20 megohms, to 1,000 v, 2,000 megohms. Accuracy is within ± 10% of indicated value for rated value, and within ± 5% of indicated value for effective measuring rating, except the rated value.
Yokogawa Electric Works, Inc, 40 Worth St, New York 13, N. Y.

Motor-Load Indicator . . .

. . . is used on either single or 3-phase, 50 or 60-cps induction motors in conjunction with a 5-amp current transformer. The panel instrument measures the useful component of load current (I Consine θ). An ac ammeter measures current



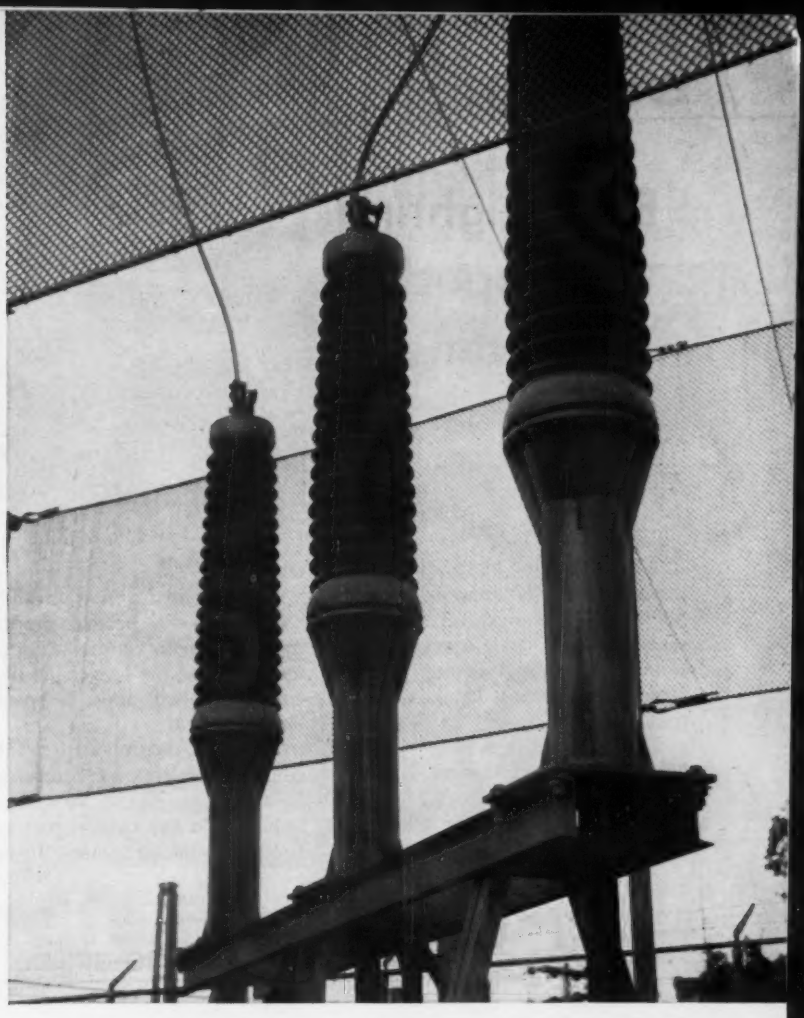
magnitude without respect to power factor; it gives accurate indication at light loads without sacrificing full-load indication. When two resistor links are attached, the meter is calibrated for 190-280 v; when they are removed, meter voltage increases to 350-550 v.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Safety Latches . . .

. . . for converting standard hoist hooks to safety hooks are available in eight sizes for hoist hooks of ¼-ton to 10-ton capacity. The safety device, which can be fitted on any hook in minutes, using only hand tools, has two major parts: a clamp-on collar and a spring-loaded safety latch for the hook opening.
The Harrington Co, Gravers Rd, Plymouth Meeting, Pa.

ANOTHER FIRST from G&W

"a significant step forward in the termination of high-voltage cable"*



The first use of a commercially available

138 kv HIGH PRESSURE ALL-GAS POTHEAD

in which the porcelain is subjected to full line pressure

The very first pothead to be used commercially was designed by the founders of G&W. Over fifty-five years later and many other "firsts," G&W engineers have produced the most complete line of potheads available to industry. You can specify the pothead of your choice with utmost confidence.

G&W experience, engineering skill, and the manufacturing resources at its command are second to none. They are your positive guarantee of satisfaction.

Write today for your copy of "MORE POWER DOWNTOWN".

* *This quote is from an authoritative article titled, "More Power Downtown". The article gives full facts on new ideas used in the construction of a 110 kv underground system on the West Coast. Describes techniques you'll want to know about—"must" reading. Send for your copy today.*

G&W ELECTRIC SPECIALTY CO.

3500 W. 127th Street • Blue Island • Illinois

Canadian Mfr. – Powerlite Devices, Ltd., Toronto, Montreal & Vancouver

Bank Lighting Upped to 70 Ft-candles

A bank lighting installation which increased the illumination four-fold has meant greater speed and accuracy for bank employees and an Illuminating Engineering Society award for two San Francisco electrical engineers.

Color-corrected 400-w mercury lamps, replacing 500-w incandescent lamps, were installed in a 28-ft ceiling to provide light for teller and office areas. Illumination was increased to 70 foot-candles.

Previous to the new installation, scaffolding was needed every four months to maintain the incandescent lamps. Now, the longer life of mercury lamps will allow a 3-year relamping cycle.

Shown in the photo are fluorescent lights mounted in a former skylight area, providing adequate illumination in the central part of the room for bank customers. Incandescent lamps are used in floor-mounted standards and in column urns to enhance the classic architectural design of the ceiling and for added impression of warmth.

Award-winning engineers for the lighting system were Lloyd Dehrer of Buonaccorsi & Murry Engineering Co, and John Epperson, Peerless Electric Co. They received an award for the most interesting lighting job in the nation.

SELLING BRIEFS

An electric heating symposium was staged recently by Tampa Electric Co, under theme, "Comfort Heating . . . Electrically." Advantages of electric heating and Tampa Electric promotional and advertising plans were covered. Electric heating equipment displays were erected.

Properly installed electric wiring is recommended for outdoor lighting by the head of Sacramento, Calif.'s fire prevention bureau. Open light torches "constitute a hazard that could result not only in loss of property but life itself. The fact they are not stable—that they could be pushed over onto an individual—makes them unsafe," the chief said.

Power Demand Limiter, to control power demand during warm-up period on electric unit ventilator applications, has been developed by Barber-Colman Co, Rockford, Ill. Unit consists of an outdoor adjuster and a cabinet housing a proportional amplifier, and a proportional motor operator connected by a drive chain to a percentage cycling timer.

Electric dryer sales reached a 1,028 figure in an intensive six-week campaign at Houston Lighting & Power Co. Company's new residential electric service rate which provides a 5¢-a-day average operating cost for dryers was featured in the promotion.

"Your Automatic Washer," a booklet designed to acquaint prospective and new purchasers with **automatic washers,** has been prepared by the American Home Laundry Manufacturers' Assn. How to avoid service, but what to do if it is necessary, are also included.

$100 subsidy will be paid to residential customers who replace inadequate electrical service entrance panels with 200-ampere installations to increase their electrical usage. Okanogan County PUD (Wash). is offering the subsidy in launching its "break-the-bottleneck" promotion program.

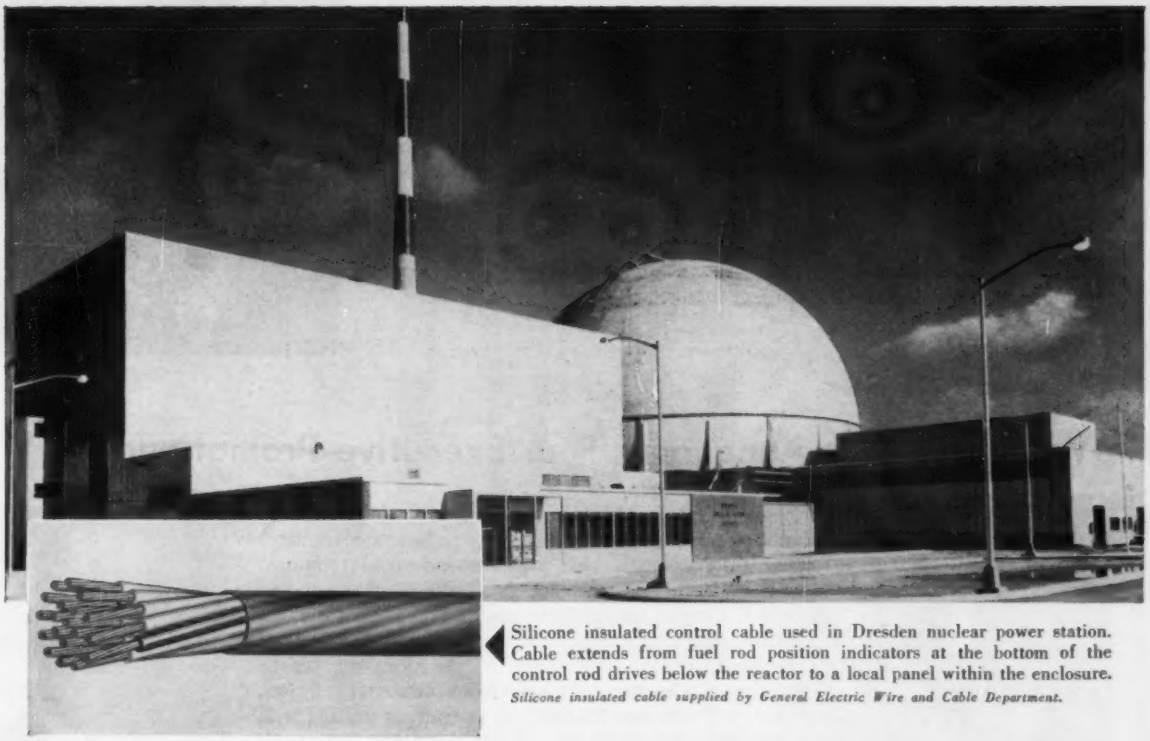
Seattle, Wash., homebuilder includes a photo-electric **yard light** in the price of homes he builds. Lights are mounted in front yards and light sidewalks and yards.

Carolina Power & Light Co conducted a **market survey** which, cost $6,100. If each customer who received a 150-w light bulb for filling out the survey form replaced a 60-w lamp with the new bulb, the revenue gained from the additional wattage liquidated the expense within six months, the company estimates.

The quick recovery **water heater** is absolutely essential to get a more competitive size of heater that will provide the customer with enough hot water for his needs today and tomorrow in the Monongahela Power Co service area according to H. A. Stroud, promotion manager.

General Electric Silicone Rubber Insulation chosen for Dresden Nuclear Power Station

Excellent moisture and heat resistance, protection against gamma radiation



Silicone insulated control cable used in Dresden nuclear power station. Cable extends from fuel rod position indicators at the bottom of the control rod drives below the reactor to a local panel within the enclosure.

Silicone insulated cable supplied by General Electric Wire and Cable Department.

Because it combines many desirable properties, particularly a combination of heat and radiation resistance, General Electric silicone rubber insulation is being specified for control and power cable in atomic reactors and other nuclear power generation equipment.

G-E silicone rubber also provides a more reliable and efficient cable insulation for many other electric utility and industrial applications. Among its many advantages are the following:

Excellent Heat Resistance: In power cable applications, offers long service life at temperatures up to 150°C; overload temperatures to 225°C; short-circuit overload temperatures even higher.

Extra Current-Carrying Capacity: As a result of its excellent heat resistance, cable insulated with G-E silicone rubber can carry up to twice the current as can conventional cable of the same size.

Low Moisture Absorption: Easily withstands moist operating conditions that may cause other insulations to fail.

High Ozone Resistance: Ozone and corona, which cause rapid aging of organic rubber, have negligible effect on silicone rubber.

Low Temperature Flexibility: Class 900 electrical grade G-E silicone rubber stays flexible at temperatures down to −60°C, special grades to −100°C.

Radiation Resistance: G-E silicone rubber insulation will withstand gamma radiation up to 1×10^8 roentgens, about 20 times higher than fluorine-containing insulation.

For more facts and figures on G-E silicone rubber insulation, write General Electric Company, Silicone Products Department, Section **FF213,** Waterford, New York.

GENERAL ELECTRIC

SILICONE PRODUCTS DEPARTMENT

Section FF213, Silicone Products Department
General Electric Company, Waterford, New York

Please send me further data on silicone rubber cable insulation.

Name_____ **Title**_____

Company_____

Address_____

City_____ **Zone**_____ **State**_____

Hodges Named VP of Appalachian Power

Richard E. Hodges has been elected vice president and general manager of the Appalachian Power Co. Hodges, who had been assistant general manager, succeeds G. L. Furr who retired February 1 as general manager but continues as a vice president and consultant.

Hodges started with the Kentucky Power Co in 1926. In 1940, he was named assistant general manager and, in 1943, general manager, both at Ashland, Ky. In 1948, he moved to Appalachian's Charleston, W. Va., Division as division manager, and to Roanoke as assistant general manager in 1954.

Furr has been with Appalachian since 1916. He was named manager of the Bluefield Division in 1943, assistant manager of the company at Roanoke in 1946, and vice president and general manager in 1952.

Wagner Electric Announces Four Executive Promotions

FELTON

Wagner Electric Co has made the following executive promotions: Harold N. Felton to vice president-marketing; Ralph W. Boeringer, vice president-industrial relations; Carl E. Widell, assistant vice president, marketing; and Harold S. Garrett, director of purchases.

Felton, who also was made a director, will be responsible for the Electrical and Automotive Divisions' marketing.

Boeringer, who was promoted from industrial relations director, will continue to direct all operations dealing with the company personnel. Widell was formerly director of market expansion, and Garrett assistant director of purchases.

BOERINGER

Stone & Webster Engineering Corp Elects Argue President

Stone & Webster Engineering Corp has elected Fred W. Argue, president. He succeeds T. Cortlandt Williams who was promoted to chairman of the board. Alfred L. Hartridge was named executive vice president and Dr Arthur J. Good, vice president and treasurer.

Argue joined Stone & Webster in 1941 as a power engineer after 20 years with utilities and in engineering education. He was elected executive vice president in February, 1959, after serving as engineering manager since 1954.

Williams, who joined Stone & Webster in 1923, has been president since 1955. While with the organization he has directed the construction of different projects including the atomic energy installations at Oak Ridge, Tenn.

Hartridge was made treasurer in 1953 and vice president in 1954. He joined Stone & Webster in 1931 and served in the field on various construction projects and in the New York and Boston offices.

Good was named comptroller in 1956 after being managing director of the Stone & Webster engineering affiliated company in London for five years. He most recently was vice president as well as comptroller.

ARGUE

WILLIAMS

HARTRIDGE

GOOD

(*More News About People, p* 96)

Radially laminated cores for single phase transformers

By E. H. Stauffer, Project Engineer, Brown Boveri Corp.

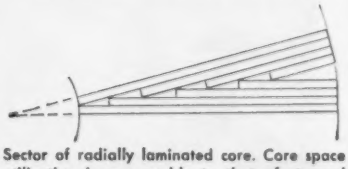
BROWN BOVERI

Brown Boveri's radially laminated cores allow the design of high-rating units with reduced height and weight and greater efficiency . . . to meet rail and highway limitations and to reduce costs.

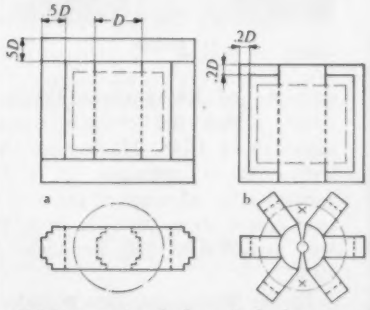
Magnetic flux passes in and out of a transformer core through the edges of the core laminations. Thus, in a parallel laminated core, flux flows only in parallel planes. In a radially laminated core, flux enters from all directions — providing a number of advantages:

Reduced height.

Yoke height is reduced to about 20% of limb diameter. A large single-limb transformer with a 40" diameter radially laminated core, for example, will save up to 5 ft. of building height or shipping clearance as compared to conventional three-limb transformers.



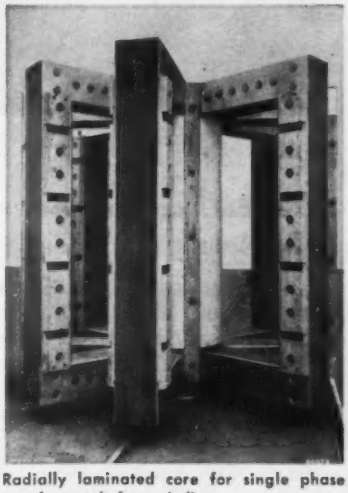
Sector of radially laminated core. Core space utilization is comparable to that of stepped parallel laminations.



Height comparison for large single-phase transformers. a — parallel laminations. b — radial laminations. Empty sectors at x allow room for connections or taps to inner coils.

Lower losses.

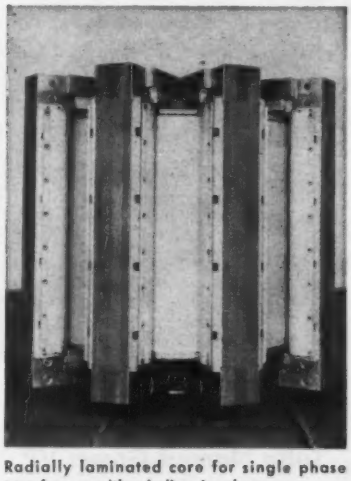
All core laminations face edgewise to the concentrically arranged coils . . . reducing stray losses and eddy currents to a minimum.



Radially laminated core for single phase transformer, before winding.

Lower material costs.

The lower yoke height means considerably less iron is required. The lower, horizontal parts of the yokes also serve as coil supports so that elaborate bases are eliminated. The simple circular tank needs no wall reinforcements, uses a minimum amount of oil.



Radially laminated core for single phase transformer with winding in place.

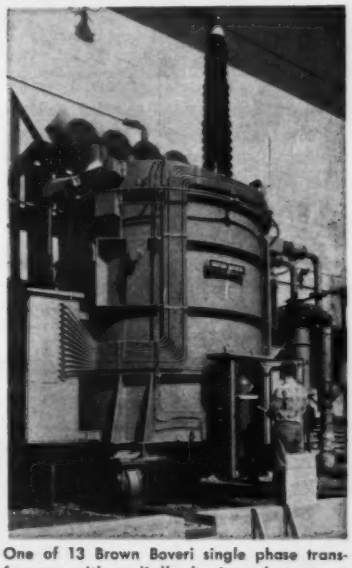
Lower assembly costs.

Butt-jointing of yokes eliminates interleaving of yoke and core laminations, simplifies construction.

Other core construction features:

Special selection and preparation of core sheets and the use of non-magnetic or shielded pressure plates, bolts and screws reduce no-load current and iron losses. Yokes are tied rigidly to the central core with non-magnetic bolts for minimum noise level.

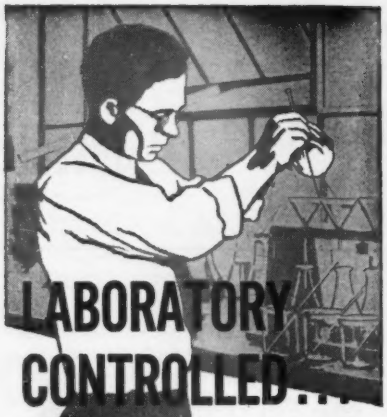
The total capacity of Brown Boveri transformers built with radially laminated cores is now over ten million kva. *None has shown any trace of iron troubles.*



One of 13 Brown Boveri single phase transformers with radially laminated cores at Robert Moses Dam, Massena, N. Y. All are 3-winding type, equipped with forced oil-water heat exchangers and rated 86,000 kva. Six are 115-13.2/13.2 kv, six are 230-13.2/13.2 kv. The spare is reconnectable for either voltage.

NOTE: Brown Boveri's "Splayed Flange Insulation" also reduces transformer size by reducing the distance between windings and the size of the core. This unique insulation is described in another advertisement.

BROWN BOVERI Brown Boveri Corp., Dept. EW22, 19 Rector Street, New York 6, N. Y. Agents in 27 U. S. cities



LABORATORY CONTROLLED...

Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

DREWRY

SoCalEd Appoints Drewry Department Manager

W. C. Drewry has been appointed manager of Southern California Edison Co's commercial department. He succeeds H. V. Busby, retired.

Drewry has been manager of commercial services since 1955, and with SoCalEd since 1946. Before that he spent 12 years with Virgina Electric & Power Co. With Southern California Edison he has been a power engineer, commercial supervisor, supervisor of tariff application, and manager of tariff administration.

TULLO

Tullo Named Group VP Of Worthington Corp

Aloysius M. Tullo, vice president and general manager of Worthington Corp's Harrison, N.J., Division, has become a group vice president, replacing Elston J. Tribble who has resigned.

William A. Finn was promoted to general manager of the Harrison Division, and Frederick B. Seel becomes general manager of the Holyoke Division.

Tullo, who has been with Worthington for over 35 years, was made general manager of the Harrison Division in 1955 and a vice president in 1956.

Barr Elected VP-Sales Of Keasbey & Mattison

Norman L. Barr has been named vice president-sales and a member of the board of directors of Keasbey & Mattison Co.

Barr, who has been general sales

BARR

manager of K&M since January, 1959, joined the company as a salesman in 1948. He became Atlanta district manager in 1953, general sales manager of the Asbestos-Cement Pipe Division in 1956, and assistant to the president in 1958.

D. W. Widmayer, vice president, has retired.

PERSONAL BRIEFS

Harlan J. West has been promoted to special assistant to the vice president, engineering at Pennsylvania Power & Light Co. Succeeding West as station electrical engineer will be **Paul Holtz.**

Charles Parker has been promoted to chief engineer, Linden Generating Station, Public Service Electric & Gas Co.

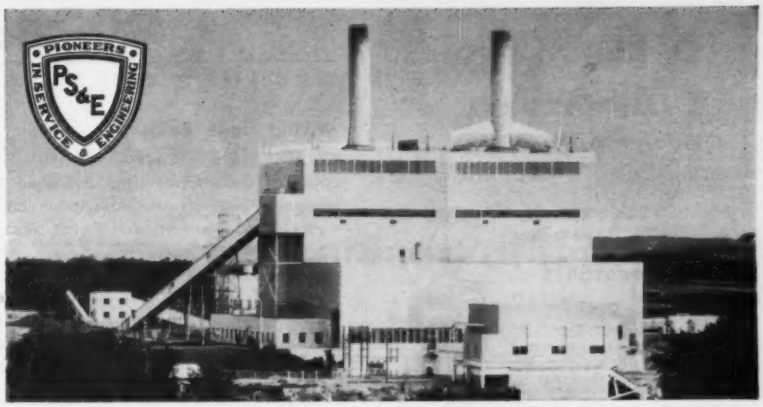
Virginia Electric & Power Co's operating manager, **Walter J. Matthews,** has been elected president of the Central Richmond Assn.

Tennessee Valley Authority has a new organization which includes an advisory staff in the power manager's office, five major divisions, and four service, planning and research staffs. The advisory staff will review and advise on major aspects of the power program: **Merrill DeMerit** on engineering and planning activities; **C. L. Karr** on operating phases; and **E. R. Wall** on distributor relations. Power Planning and Engineering Division will be under the direction of **K. E. Hapgood;** Power Marketing Division, **J. E. Watson;** Power System Operations Division, **C. P. Almon Jr;** and Power Production Division, **E. E. Robinson. W. B. Richardson** will be in charge of the Power Construction Division; a management services staff will be headed by **R. L. Forshay. R. A. Kampmeier,** assistant manager of power, will also serve as acting head of a financial planning staff, and a fuels planning staff and a research staff will be under the direction of **E. P. Ericson** and **W. E. Dean Jr,** respectively.

F. E. Berry has been appointed general manager of the Powell Valley Electric Co-op, Jonesville, Va., succeeding **D. B. Fletcher** who died recently.

OBITUARY

Frank C. Gordon, 62, assistant treasurer of Consolidated Edison Co of New York . . . **Austin C. Ross,** 66, former vice president of Worthington Corp . . . **Frederick Keller,** 62, president of Thomas Industries . . . **Georges Destriau,** 56, discoverer of electroluminescence . . . **Joseph E. Kewley,** 76, former General Electric Co vice president, and general manager of the Lamp Division . . . **Bernard P. Shearon,** 79, retired vice president of Indiana & Michigan Electric Co.



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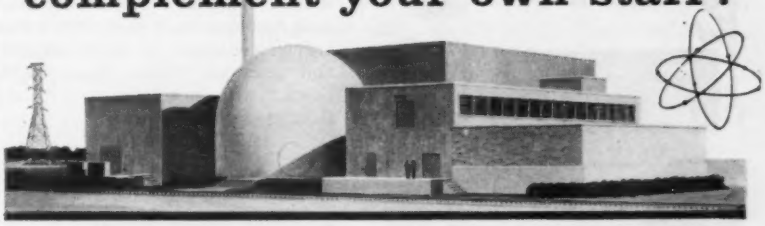

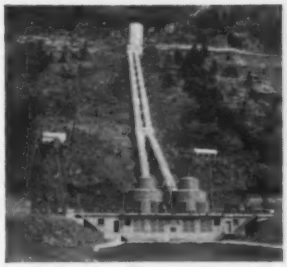

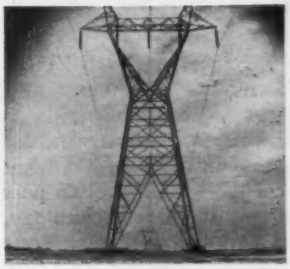

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Books

Wiring Code Revised

National Electrical Code—1959. By NFPA Electrical Code Committee. Published by National Fire Protection Association International, 60 Batterymarch Street, Boston 10, Mass. 528 pages, illustrated. Price $1.00 paperbound.

Replacing all previous editions of the National Electrical Code, this 1959 edition incorporates many changes in residential wiring reflecting the growing demands of electrical appliances. Rearrangement of contents makes for greater clarity and a convenient index facilitates study of changes.

The revised Code has been submitted for approval by American Standards Association. It should be a standard reference for all utility engineers and salesmen whose duties include contact with customers or with contractors.

Correlating Scientific Theories

Molecular Science and Molecular Engineering. By Arthur R. von Hippel. Published by Technology Press of M.I.T. and John Wiley & Sons Inc, 440 4th Ave, New York 16, N Y. 461 pages, illustrated. Price $18.50

This third volume of a trilogy on modern materials research deals with applications of molecular theory to new materials.

Utility engineers will be interested in chapters on thunderstorms, dielectric breakdowns, and gaseous explosions, as well as its study of irradiation effects on materials.

Law and Construction

Legal Aspects of Construction. By Walter C. Sadler. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y. 388 pages, illustrated. Price $8.50.

Whether a utility builds a transformer vault or a steam generating station, it must assume many legal burdens and responsibilities. Not all of these are solely the province of the legal department. The engineer engaged in design and construction should be aware of some of the problems that can arise.

This book, written clearly and thoroughly, treats many of the situations which may occur. The author, a professor of civil engineering, is both an engineer and an attorney and does not burden the book with legal phraseology. Although the book is not intended to take the place of competent legal counsel, it is an invaluable guide to "preventive law" for those concerned with construction.

Books Recently Received

Handbook of Electronic Control Circuits. By John Markus. Published by McGraw-Hill Book Co Inc, 330 W 42nd St, New York 36, N. Y. 347 pages, illustrated. Price $8.50.

Electrical Engineering for Professional Engineers' Examinations. By John D. Constance. Published by McGraw-Hill Book Co Inc, 330 W 42nd St, New York 36, N. Y. 448 pages, illustrated. Price $9.50.

Transformers for the Electric Power Industry. By Richard L. Bean, Nicholas Chackan, Jr., Harold R. Moore, and Edward C. Wentz. Published by McGraw-Hill Book Co Inc, 330 W 42nd St, New York 36, N. Y. 409 pages, illustrated. Price $12.50.

Theory and Design of Small Induction Motors. By Cyril G. Veinott. Published by McGraw-Hill Book Co Inc, 330 W 42nd St, New York 36, N. Y. 477 pages, illustrated. Price $13.50.

Analog Methods. By Walter Karplus and Walter Soroka. Published by McGraw-Hill Book Co Inc, 330 W 42nd St, New York 36, N. Y. 483 pages, illustrated. Price $12.50.

Automation Cybernetics and Society. By F. H. George. Published by Philosophical Library, New York. 283 pages, illustrated. Price $12.00.

Digital Computer Primer. By E. M. McCormick. Published by McGraw-Hill Book Co Inc, 330 W 42nd St, New York 36, N. Y. 205 pages, illustrated. Price $7.50.

Electric Energy Conversion. By Y. H. Ku. Published by Ronald Press, 15 E 26th St, New York. 516 pages, illustrated. Price $10.00.

Primer of Lamps and Lighting. By Willard Allphin. Published by Chilton Co, Book Div, 56th and Chestnut Sts, Philadelphia 39, Pa. 241 pages, illustrated. Price $10.00.

Eliminates Blank Tape

(*Continued from page* 65)

the input. When an impulse is received, one transistor draws current changing the bias on other transistor, causing the latter to draw current which operates the relay.

The RC time constant of the coupling circuit determines the time that the relay contacts are closed. The time constant of this circuit, much longer than necessary to operate digital counters, gives enough time for the maximum rate of eight impulses per min.

The relay contacts energize the electric counting mechanism and record one number for each impulse reaching the input. The diode across the relay coil prevents transients from triggering the circuit. The diode in the input insures the proper polarity on the input trigger pulse. The power supply is a split feeder because the sudden voltage drop caused by one transistor circuit drawing current would trigger the other transistor circuit. Cables, alligator clips and plugs provide quick and safe connection of test counter to recorder.

Sales Problems

(*Continued from page* 47)

It can include ad reprints, brochures, fact sheets on installations, article reprints or sales letters.

Asked what share of the total I&C budget should go into ads and promotion, Hofsoos ducked a direct answer. When one delegate said his department allocates 10%, the ad agency vice president said this was probably "very high" in comparison with average utilities.

Another trend that I&C men are watching is the use of all customer contact employees in selling service to residential customers. Some facets of this might prove useful in I&C promotion.

A majority of the seminar delegates represented gas utilities. At the close of the session, one electric company sales manager had this to say: "There's been one plus to this that wasn't listed on the program. After listening to these gas men and talking with them, I'd say they're about where we were four years ago."

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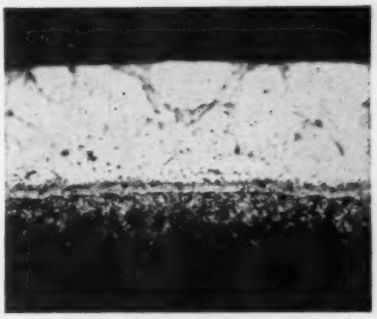

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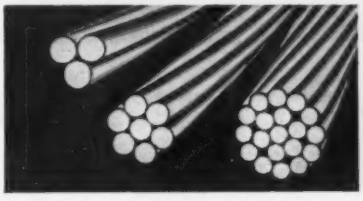

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Wanted—Electrical Engineers. Minimum five years experience in public Utility Distribution, Transmission, Metering and Relaying. Required for permanent, responsible positions in Venezuela. Spanish an asset but not essential. Good living conditions. Starting salary of $13,000 per annum. P-3537, Electrical World.

Wanted—Graduate Electrical Engineer. Electric Utility in Eastern Massachusetts. Some experience in transmission and distribution desired. Please answer, giving education, experience and salary expected. Write to P-3628, Electrical World.

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Illinois Court Rules Out Normalization

Petitions for rehearing filed after the Supreme Court upsets the state regulatory commission's decision on liberalized depreciation

The Illinois Supreme Court, in a decision of wide industry interest, has ruled that the state's utility companies using liberalized depreciation will be allowed only actual taxes for rate making. Essentially, the court's position is that normalizing taxes is an enforced interest-free loan. Thus, the earnings resulting from tax deferrals provide a return on money that the stockholders did not invest in the utility.

The case involves a $9,300 tax write-off by Alton Water Co, which is part of the American Water Works Co's Western Division. The subsidiary filed for a rehearing on Feb. 6. Illinois Commerce Commission also has filed a separate petition for a rehearing.

In addition, the accounting firm of Arthur Andersen & Co and Illinois Power Co have asked for and obtained leave to file a petition amicus (intervening as an interested party) by this Wednesday. Commonwealth Edison Co planned to petition as an intervenor, a spokesman said earlier this month.

Fair Value Finding Sustained

This is the first instance where a court has reversed a state regulatory commission decision on the treatment of Section 167 of the Internal Revenue Service code. Alton Water Co's disappointment was tempered when the high court sustained the commission's liberal fair value finding and said that a return of 17% on the common stock investment, valued at par, was reasonable. The court said that the mere incidence of high debt leverage, which produces this high a return, is no excuse for reducing the earnings on common stock. "It would be inconsistent to judge the overall return on the basis of fair value but judge the return accruing to common stockholders on the basis of a par value which is essentially original cost," the court said. "The significant figure is the rate of return on common stock valued at fair value."

In ordering the flowthrough method, the court cited the Central Maine Power Co case of last year in which the Maine Supreme Court also decreed that funds resulting from deferrals should flow through to earnings.

The purpose of Section 167, according to the Illinois court, is to encourage small, growing, high-risk businesses. This view doesn't coincide with the report by the House Ways & Means Committee which said:

"The faster tax write-off would increase available working capital and materially aid growing businesses in the financing of their expansion. For all segments of the economy, liberalized depreciation policies should assist modernization and expansion of capacity . . ."

Briefs Did Not Explore Complex Facets

In commenting on the court's decision, a spokesman for Commonwealth Edison Co said the complicated accounting and financial problems and the considerations of utility regulation that are involved were not fully explored in the Alton Water Co briefs because the item was not critical to the result in that proceeding.

"For the foreseeable future," the Commonwealth Ed man said, "we expect no adverse effect on our reported earnings. On the other hand, we doubt whether stockholders would be warranted in anticipating an earnings improvement from a presumed adoption of the so-called flowthrough accounting method."

One observer noted that the court's decision "seems to be confused not only as to the economic consequences of liberalized depreciation, but as to the relative position of the utility, the ratepayer, and the U.S. government."

He cited the Federal Power Commission statement in dealing with accelerated amortization in the Panhandle case: The Panhandle customers "will pay the same rates; no more, no less. They neither lend nor give their money to Panhandle. It is the other two parties to the transaction who change their position—the U.S. government and Panhandle."

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This is a television camera. Its job is to photograph the substrata of excavations, thereby providing information needed by engineers in planning the construction of Boston's new Prudential Center, a modern, multi-million dollar real estate development.

Here in the Back Bay section of Boston, with its artificially maintained water table, this sealed camera must go down into a water-filled hole 100 feet below the surface. To transmit the picture from the camera to the surface monitor, Lake Service Corp. of Brighton, Massachusetts, designers and manufacturers of the television equipment, chose Simplex Anhydrex XX insulated cable because of its ability to withstand the rigors of submarine and direct burial duty.

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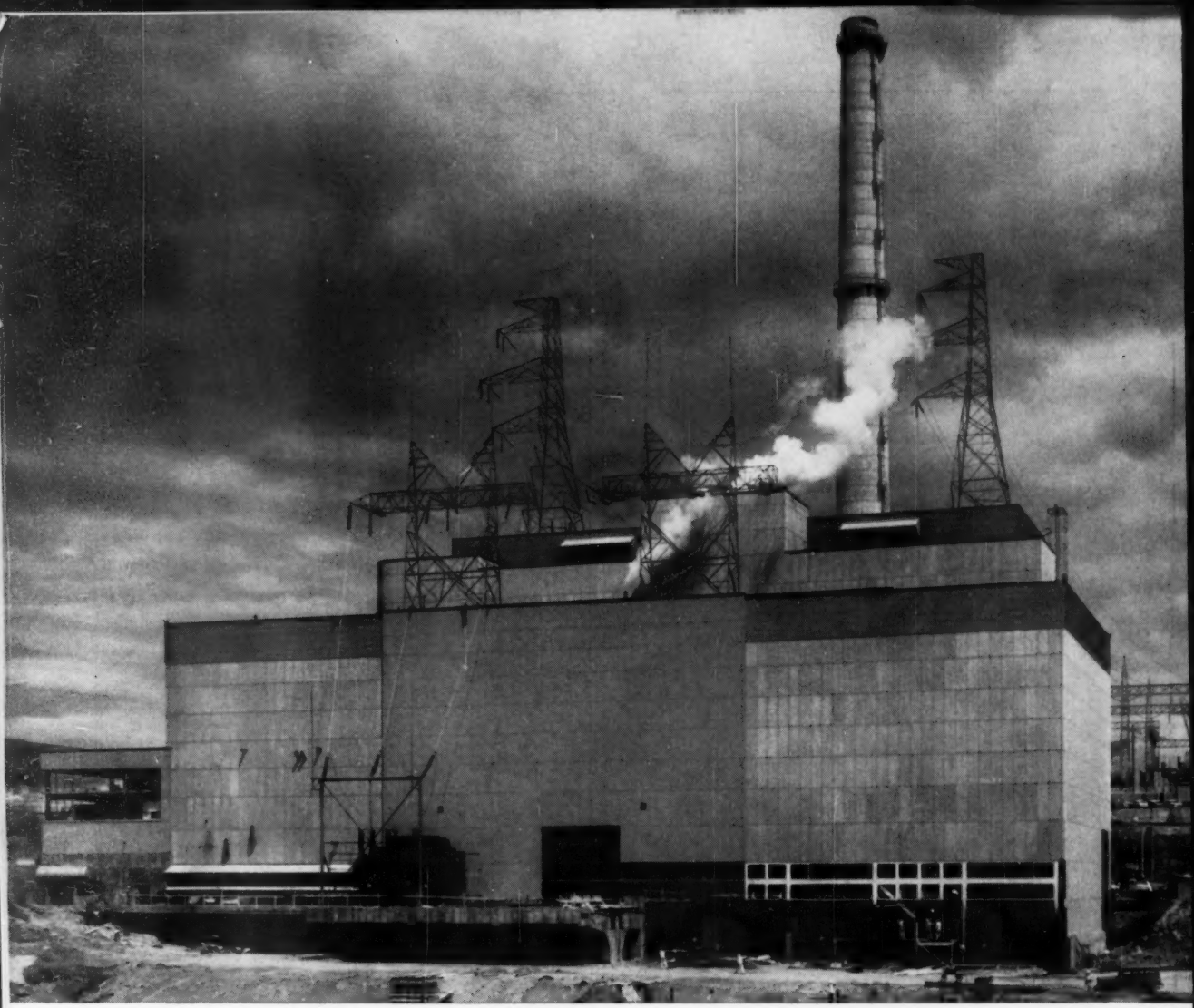

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Unit #1 of the new Dickerson Station of Potomac Electric Power Company went on the line in June 1959. A second duplicate unit is scheduled for service in early 1960. This modern station was designed and constructed by Stone & Webster Engineering Corporation in conjunction with the Engineering Departments of PEPCO. Major fluid handling equipment furnished by Worthington includes the condensers, circulating water and condensate pumps, rotative dry vacuum pumps, boiler feed and booster pumps, and main deaerators to supplement condenser deaeration in protecting the boilers and feed cycle.

The fluid handling equipment for each unit incorporates a number of special features. Included is the power-saving technique of a single full capacity boiler feed pump driven from the main turbine generator shaft through a variable speed coupling, with a spare turbine driven feed pump. Use of booster pumps also permitted mounting the main deaerator on the turbine room floor, thus minimizing cost of supporting structure and piping.

The condenser serving each unit is 110,000 sq. ft. two-pass, of special construction for maximum deaeration. It is rigidly mounted with rubber belt-type expansion joint in the turbine exhaust connection, and equipped with built-in reverse flow valves for periodic backwashing. The separate screenhouse at the river contains four circulating water pumps of vertical single suction volute MIXFLO dry pit type, driven by two-speed induction motors, supplying 95,000 gpm to each unit.

As a manufacturer of major steam cycle fluid handling equipment, Worthington has a reservoir of "system-wise" experience available to help in your power planning projects. For information, call your nearest Worthington District Office. Or, write to Worthington Corporation, Section 45-15, Harrison, New Jersey.

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